
## COPYRIGHT AND CITATION CONSIDERATIONS FOR THIS THESIS/ DISSERTATION


- Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

- NonCommercial — You may not use the material for commercial purposes.

- ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.

### How to cite this thesis

Surname, Initial(s). (2012). Title of the thesis or dissertation (Doctoral Thesis / Master's Dissertation). Johannesburg: University of Johannesburg. Available from: http://hdl.handle.net/102000/0002 (Accessed: 22 August 2017).

# The Determinants of the South African Financial Cycle

by

**Zenzele Mwansa Pahla**

A dissertation submitted in fulfilment for the Degree
of
Master's in Commerce
in
Development Economics



at the
College of Business and Economics
**UNIVERSITY OF JOHANNESBURG**

Supervisor: Prof A Kabundi
Co-Supervisor: Dr A Pholo

**2019**

## DECLARATION

I certify that the *minor dissertation/dissertation/thesis* submitted by me for the degree *Master's of Commerce (Development Economics)* at the University of Johannesburg is my independent work and has not been submitted by me for a degree at another university.

ZENZELE MWANSA PAHLA_____
(Name in block letters – no signature)

# Acknowledgements

*"The beautiful thing about learning is that no one can take it away from you." B.B. King*

If there is one thing that Themba Pahla left with me before he passed away, it was the above quote. An artist at heart, he rose from nothing and worked hard to become the holder of a master's degree in mining engineering from the UK. Daddy, with this, I hope I have made you proud! And my other Father, Papa, I can't believe that this was in your plan for my life all. Thank you from the bottom of my heart for this amazing gift – you are truly the one who made this possible, thank you a thousand times over.

To the Fellowship of my Mini-Dissertation:

Prof. Alain Kabundi, aka Gandalf the 'Great' – You are the wizard of Monetary Policy! You took a chance on me and taught me so much. Thank you for your time, patience and wisdom. I have enjoyed working with you so much and I am eternally grateful for all you have taught me … thank you beyond words can express.

Dr Marinda Pretorius, aka Samwise Gamgee – You are the best friend any person could have wished for! Thank you for always picking me up when I was down and giving me the strength to continue when I thought it couldn't be done.

Mummy and Sarai, aka Merry and Pippin – You kept me laughing and smiling even when the going was tough! This is our mini-dissertation, not just mine, because you suffered through hearing about financial cycles, credit and capital buffers with me. I love you more than words can say and thank you for allowing me to study for so long.

Dr Arnold Wentzel, aka Aragorn – You were the one who inspired my love of monetary policy! Thank you so much for the foundation you set. You showed me transmission mechanisms and modern monetary theory, you taught me how to write and encouraged me all the way through. Thank you for your love of teaching; hopefully one day I can inspire others as you have inspired me.

Dr Chitalu Lumbwe, aka Gimli – You were the one who refused to give up on me! When all others thought I would not amount to much, you pushed through and made me believe in myself to the point that I started studying again. Thank you, uncle, for your belief in who I am and who I can be.

Dr Tim Ng, aka Legolas – You are the sharpest economist I know! Thank you for helping me lay the groundwork and helping me to understand all the concepts along the way. While we have never met, you contributed so much to this project and I am eternally grateful for your time and patience in wanting to help me.

Antoinette Malinga, aka Boromir – You are the one I lost along the way. I wish you could be around to see this, you would've been so proud! I know you're looking down from heaven and smiling, and I couldn't have done this without your endless support. I miss you beyond what words can express.

Finally, to the Queens and Kings of Rohan who made this possible: Granny, Auntie Kaluba, Auntie Rachel, Siobhan, Shehnaaz, Dr Kapambwe Lumbwe and Prof. Hardus van Zyl. Thank you so much for your belief and encouragement, I could not have seen this project through without you. And a very special mention to Dr Alain Pholo! You saved this mini-dissertation, thank you so much for your time, effort, comments and encouragement. I am grateful beyond what words can express.

## Abstract

Since the 2007/8 global financial crisis, common factors such as low and protracted global interest rates may have sustained rising debt levels in emerging market and developing economies (EMDEs) like South Africa. This mini-dissertation attempts to characterise the South African financial cycle so as to determine the role of common global factors that potentially drive South African debt levels. First, the South African credit-to-GDP gap is constructed using the Hodrick-Prescott (HP) filter to determine the role of private sector credit frictions in generating domestic credit procyclicality. Next, a dynamic factor model is used to characterise the South African financial cycle with 13 macro-financial variables from 1980 to 2016. The South African financial cycle is then decomposed to determine the driving forces, and then compared to the Miranda-Aggripino and Rey (2018) global financial cycle and the VIX, to disentangle the effects of common global from idiosyncratic factors. The results reveal that the South African credit cycle is weakly countercyclical, suggesting the domestic business cycle may lead credit growth. Additionally, the South African financial cycle is driven mainly by common movements in the funding, credit, equity and global markets. Moreover, moderate positive co-movement with the global financial cycle, and stronger negative co-movement with the VIX, suggests the South African financial cycle is not isolated from common global factors. Therefore, we can infer that South African post-crisis debt growth may be a symptom of low and protracted global interest rates over the period. Based on these results, policymakers are advised to consider targeted macroprudential measures, such as balance sheet stress testing and macroprudential levies, to manage specific vulnerabilities.

Keywords: Emerging Market Debt, HP Filter, Global Financial Cycle, Factor Analysis, Macro-Financial Linkages

JEL Classification: E32, E44, F34, F41, F62

# Table of Contents

# List of Figures and Tables

# Introduction

While advanced economies (AEs) have experienced substantial deleveraging since the 2007/8 global financial crisis, debt levels in emerging market and developing economies (EMDEs) have been increasing steadily (Bank for International Settlements [BIS], 2015; World Bank, 2018). This phenomenon has occurred most prominently in the South African public sector, with government debt increasing from 40% of GDP in 2008 to approximately 50% of GDP in 2017 (South African Reserve Bank [SARB], 2018a). With the rise in financial globalisation, the composition of external debt has evolved. Specifically, the majority of South African external debt has shifted from foreign currency to rand-denominated government debt held by non-residents. This could merely reflect improved global investor diversification and capital market deepening in South Africa. However, it also raises the potential for systemic default risk through currency mismatches and public finance fragility.

Despite external debt growth becoming associated more with banking sector fragility through foreign currency mismatches, empirical evidence finds a limited role for nominal exchange rate movements in explaining this relationship for EMDEs (World Bank, 2018). This then raises questions about the relationship between domestic credit procyclicality and cross-border capital flows. From a broad macro-financial perspective, it requires an inquiry into the relationships that govern both domestic and global financial frictions that may be characterised by the financial cycle. It is against this backdrop that this mini-dissertation questions the common movements that drive the systematic build-up of credit default risk in the South African financial system. Specifically, the study questions what determines the South African financial cycle? And, is it isolated from common global financial movements? If the South African financial cycle is not found to be isolated, then we may infer that current levels of government debt growth may be a symptom of depressed global interest rates over the post-crisis period.

Despite a strong theoretical basis through financial accelerator (FA) models, there is no consensual definition of the financial cycle. Generally, it refers to the tendency of financial frictions to amplify business cycle fluctuations through changes in the perception of value, risk and financing constraints. Therefore, various approaches

exist to characterise the financial cycle. As a strong indicator of financial system stress, the credit cycle may be used to capture rising default risk. However, it only provides an indirect measure of systemic risk that arises from private sector frictions. Moreover, studies find that credit frictions tend to affect systemic risk more significantly when combined with asset prices. This leads some authors to characterise the financial cycle using a combination of credit aggregates and asset prices.

Given the relationship between credit and collateral, Borio (2012), Drehmann, Borio & Tsatsaronis (2012) and the SARB (2015) find credit, property prices and equity prices to provide the most parsimonious description of the financial cycle. However, while credit and equity prices appear to be more correlated for AEs, Terrones, Kose and Claessens (2011) find credit and exchange rates to be more correlated for EMDEs. While this is consistent with the latter countries' susceptibility to currency risk, it also implies that a more comprehensive characterisation of the financial cycle is warranted. This can be addressed by including variables that represent various sectors of the macro-financial system. One approach is to characterise the financial cycle based on the idea of a financial conditions index (FCI).

FCIs attempt to provide a summary measure of domestic macro-financial conditions by capturing the common movements among a broad set of variables that influence economic behaviour (Hatzius, Hooper, Mishkin, Schoenholtz & Watson, 2010; Kabundi & Mbelu, 2017). In addition to credit and asset prices, variables that are included generally range from banking sector leverage and liquidity indicators to credit spreads, exchange rates and commodity prices. Therefore, by including variables that capture terms of access to financing and risk attitudes, FCIs can be used to provide a close approximation of the general definition of the financial cycle. Moreover, by including currency fluctuations and global commodity prices, FCIs make an explicit attempt to capture global changes that may influence the domestic macro-financial landscape.

From a global perspective, evidence seems to point to significant co-movement among variables such as risky asset prices, financial aggregates and cross-border leverage and credit growth (Bruno & Shin, 2015a, 2015b; Cerutti, Claessens & Ratnovski, 2017; Forbes & Warnock, 2012; Fratzscher, 2012; Nier, Saadi & Mondino, 2014). Miranda-Agrippino and Rey (2018), Passari and Rey (2015) and Rey (2013) define this

phenomenon as the global financial cycle. The global financial cycle may be interpreted as a reflection of aggregate global risk aversion based on its relationship with the Chicago Board Options Exchange (CBOE) Market Volatility Index (VIX). The CBOE VIX is measured by the implied volatility of the S&P 500 index options and is frequently used as a proxy for aggregate economic uncertainty and investor risk aversion. Since the global financial cycle is shown to exhibit a negative relationship with the VIX, it may then be characterised as a measure of global financial market strain and risk perception.

Using the structural negative relationship with the VIX in a model with heterogeneous investors, Miranda-Agrippino and Rey (2018) represent the global financial cycle as a reflection of the combined preferences and constraints of global banks and asset managers. When risk-neutral global banks and mean-variance global asset managers become the main investors, the combined interaction between their preferences and constraints can be identified by fluctuations in the global financial cycle. Specifically, the combination of risk-taking global banks and risk-averse asset managers tends to reduce global risk aversion and premiums[1] over time. This translates into an upswing in the global financial cycle, where rising global asset demand and narrowing lending spreads can transmit a self-propagating mechanism of excessive leverage and risk-taking behaviour to domestic financial systems.



The potential of procyclical transmission through the global financial cycle is complicated further by the dominance of US currency in global banking. Specifically, it raises questions about the relationship between US monetary policy, the cost of global funding and the value of dollar-denominated assets and liabilities. Miranda-Agrippino and Rey (2018) find a strong link between monetary policy in the US and fluctuations in the global financial cycle. Consequently, changes in US policy rates may present a significant driving force behind the global financial cycle and its transmission to domestic economies. This implies significant monetary policy spill-overs, which in turn challenge the prevailing Mundellian trilemma theory.

[1] The risk premium is assumed to be dependent on the wealth distribution between leveraged global banks and asset managers, such as insurance companies, sovereign wealth funds or pension funds (Miranda-Agrippino & Rey, 2018).

The trilemma theory expresses the limitations that policymakers face in the management of stable exchange rates, free capital mobility and independent monetary policy. Specifically, despite joint desirability, monetary autonomy only becomes possible under floating exchange rates regimes with free capital mobility. This suggests that US monetary policy spill-overs should only occur in situations where currencies are not free to respond to changing levels of capital flows. Therefore, without controls on capital movements under a fixed exchange rate regime, national monetary policy becomes constrained by changes in US monetary policy. However, the presence of a global financial cycle in an environment with external balance sheet debt changes this relationship.

If US monetary policy is a potential determinant of domestic financial cycles through the global financial cycle, the trilemma morphs into a 'Dilemma' with the interest rate becoming ineffective (Rey, 2013; Miranda-Agrippino & Rey, 2018). Despite a floating currency with free capital mobility, national monetary policy might become constrained by responses in external balance sheet debt. This would create a national policy dilemma between output and balance sheet stability. Protracted US monetary easing would simultaneously raise the value of domestic currency (by stimulating capital inflows), while reducing the value of external balance sheet debt (through dollar depreciation). On the one hand, an easing in domestic monetary policy would reduce capital inflows and depreciate the currency. However, it would simultaneously raise the value of external debt while stimulating domestic borrowing. Therefore, post-crisis growth in EMDE debt levels may be explained by low and protracted global interest rates over the past ten years since the global financial crisis.

With that in mind, this study conducts a two-stage analysis of the determinants of South Africa's financial cycle to establish whether it is isolated from the global financial cycle or not. First, the analysis begins by constructing the South African credit-to-GDP gap to determine whether it is fully aligned with and procyclical to the business cycle. To that end, systemic risk is empirically defined as source-independent credit default risk that is faced by the entire domestic macro-financial system (De Bandt & Hartmann, 2000; Borio, Furfine & Lowe, 2001). This definition is based on the assumption that financial frictions are partly driven by changes in bank capital that influence financing constraints, which may result in system-wide build-ups of default risk. Following the

Basel Committee on Banking Supervision [BCBS], 2010) a one-sided Hodrick-Prescott (HP) filter with a smoothing parameter of 400 000[2] is used to extract the South African credit cycle, which is then compared to the business cycle to determine procyclicality.

If the South African credit cycle is found to be countercyclical, it would provide strong evidence that systemic risk may be driven by factors more common to the entire financial system. Therefore, the second stage involves constructing a more comprehensive measure of the South African financial cycle to determine the main driving forces behind common systematic risk build-up. To construct the financial cycle, the analysis uses 13 variables that capture economic behaviour and risk sentiment, and that fall within seven main sectors of the macro-financial system. Following Kabundi and Mbelu (2017) and Oet, Bianco, Gramlich and Ong (2012), the financial market is characterised by six main sectors: the credit, equity, real estate, foreign exchange, funding and global markets. Additionally, real GDP is included as a macroeconomic variable that responds to and affects changes in the financial sector. Moreover, the systemic risk is used to determine the role of common driving forces. Therefore, it is re-defined as source-dependent risk, driven primarily by cyclical forces that are common to the entire macro-financial system (Diamond & Dybvig, 1983; Borio *et al*., 2001).



Due to empirical difficulties in defining cyclical movements, there is no consensus on how these forces are assumed to drive the systematic build-up of credit default risk over the business cycle (Aikman, Haldane & Nelson, 2015; Drehmann *et al*., 2012; Terrones *et al*., 2011). Cyclical risk refers to the time dimension of systematic risk,[3] which is meant to capture non-transitory current and expected systemic vulnerabilities. While the HP filter may be used for testing systemic procyclicality, it may not be appropriate for charactering cyclical risk.[4] Therefore, this study uses a dynamic factor model (DFM) framework to extract and decompose the common movements in South Africa's financial cycle. DFMs assume that systemic risk comprises a systematic

[2] Normally, the smoothing parameter is set to 1 600 for quarterly data for no methodological reason.
[3] Cyclical risk also includes a non-systematic (idiosyncratic) component that is specific to each variable or sector in the financial system; however, the focus of this study is on the common factors that propagate the correlation among variables.
[4] This is due to the statistical formalisation of the HP filter which characterises financial frictions as unpredictable temporary (transitory) systemic shocks.

component that is a function of several stochastic risk factors[5] that are common to the system. Given an open economy framework, international diversification then reduces any remaining effects to idiosyncratic (non-systematic) factors, which may be specific to various sectors within the system. By characterising the data-generating process as being mean-reverting, the correlations between factors can be defined by factor loadings that capture the sensitivity of each variable to common systematic movements.

This study concentrates on one specific factor, defined as credit (leverage) default risk, which is characterised by the relationship between asset prices and credit losses.[6] Therefore, factor loadings reflect the response of each sector-specific variable to changes in the perception of default risk. Specifically, financial cycle upswings are assumed to represent periods in which asset prices are relatively higher than debt levels. This raises the probability of expected and unexpected credit defaults as the upswing progresses to a boom. Consequently, as the boom turns to a bust and asset prices fall, relatively higher debt levels raise the occurrence of actual defaults, which may result in systemically relevant credit losses. Therefore, upswings are assumed to represent periods of low asset price volatility, with a lower response of the system to common factors. Conversely, downswings are assumed to represent periods of high asset price volatility, with higher sensitivity to common movements.

The results reveal that the South African credit cycle is weakly countercyclical to the business cycle, suggesting a possible lead-lag relationship between credit and output. While financial accelerator theory assumes that credit leads output, countercyclicality may point to South African output leading credit growth. Additionally, asset price, commodity price, exchange rate, structural and regulatory changes all play a role in determining excessive private sector credit growth. This provides preliminary evidence that various factors influence the cyclical fluctuations that characterise the South African macro-financial system. Confirming this is that the South African financial cycle is driven by common movements within the funding, credit, equity and global markets. While banking-sector leverage contributes the highest share, it has the lowest

[5] Stochastic properties describe a type of mathematical rule that governs the probability of movement of time-series variables.
[6] This arises from the conceptual definition of credit losses: the probability of default (credit risk) or loss given default (asset-to-debt risk).

response to changes in common systematic movements. Moreover, as leverage is found to rise during downswings, the countercyclicality of the South African credit market may be confirmed.

Considering external effects, the global market contributes a significant share to common movements, with an equally high response to changes in the common factor. Moreover, the South African financial cycle shows moderately positive co-movement with the global financial cycle. This implies a moderately procyclical relationship, with evidence that global fluctuations may lead the South African financial cycle. Additionally, the South African financial cycle shows a moderately strong negative co-movement with the VIX. This implies a stronger domestic response to changes in global risk aversion that may emanate from idiosyncratic EMDE risk perception. Taken together, this suggests that the South African financial cycle is not isolated from common global financial frictions. With a highly advanced and globally integrated financial market, we can infer that post-crisis debt growth in the South African public sector may partly be driven by monetary policy at the centre.

With the consequences of increased financial globalisation remaining a contentious debate, evidence of global spill-overs as a potential determinant of the South African financial cycle implies significant challenges and opportunities for national policymaking (Miranda-Agrippino & Rey, 2018; Rodrik & Subramanian, 2009). This result becomes more significant as risks of faster paced US interest rates and dollar appreciation increase ten years after the crisis (Rey, 2016; World Bank, 2018). Given moderate exposure to the Global Financial Cycle, South African policymakers appear to face a 'dilemma' between the pursuit of output and balance sheet stabilisation. Specifically, without a move towards financial fragmentation or the use of additional policy measures, we can infer that South African monetary policy is partly dictated by monetary policy elsewhere. Therefore, this calls for the supplementary use of macroprudential measures to manage both domestic and global financial frictions during different phases of the business cycle.

As a framework, macroprudential policy represents the incorporation of financial objectives into macroeconomic policy, with the goal of addressing macro-financial stability. Specifically, it involves the identification of systemic risks and the use of various instruments that improve the measurement and management of these risks.

Therefore, instrument design tends to be guided by the reduction in potentially systemic financial risk while strengthening the resilience of the financial system to unwanted shocks (Adrian, Covitz & Liang, 2015; BCBS, 2010; Borio, 2012; Caruana, 2010; Karmakar, 2016; Liu & Molise, 2018; SARB, 2016). Prior to the global financial crisis, policymakers assumed that the optimal policy design involved 'pricking the bubble before it burst'. This is based on the idea that financial vulnerabilities can easily be identified and muted before becoming systemic by using a single instrument: the nominal interest rate. However, with the role of procyclicality in masking financial vulnerabilities that led to the crisis, policymakers have turned to alternative design options.

Since the 2007/2008 crisis, macroprudential policy has evolved with a strong focus on strengthening the system while simultaneously taking advantage of potentially destabilising imbalances. Therefore, instrument design is now guided by the building up of provisions during expansions that may be drawn down during contractionary periods. Such design philosophy, known as 'leaning against the wind', focuses on leaning against cyclical amplifications to build up provisions that can then be used to reinforce the macro-financial system against negative shocks. As such, successful post-crisis macroprudential policy involves the improved identification of systemic risks, combined with the use of instruments that are based on building up provisions during good times that can be drawn down during bad times. From a practical policy-making perspective, this requires the strategic combination of flexible medium-term buffers that *prepare* and *restore* policy scope for more aggressive long-term macroeconomic policy.

Specifically, this study suggests that monetary policy should focus on extending forecast horizons over the medium term and consider the use of temporary alternative capital controls in the case of severe currency depreciations. Given the changing composition of external debt, policymakers are advised to consider the use of a macroprudential stability levy on systemically relevant exposure to changes in externally denominated debt. Additionally, prudential policy should focus on using balance sheet stress-testing and leverage limits to reduce the amplitude of externally exposed banking sector asset values. Specifically, there should be an increased frequency of targeted stress testing of banks and corporations with higher exposure

to external assets, and tougher leverage limits for institutions and corporates with highly sensitive debt service costs.

Finally, fiscal policy should consider targeted taxes on international credit flows directed towards funding other than public sector restructuring. Financing could then be directed to education, healthcare and public infrastructure upgrades through tax exemptions. Given the anticipated changes in global export demand, all policy measures should be guided by overarching macroeconomic objectives aimed at long-term export-sector diversification. Specifically, targeted and well-managed strategic investment funds (SIFs) could be set up to build long-term fiscal capacity. Additionally, increased education and training support for absorbing new technologies would improve labour market efficiency, while fostering the entrepreneurship and innovation that are necessary for sustainable long-term growth and development (Callen, Cherif, Hasanov, Hegazy & Khandelwal, 2014; World Bank, 2018).

This mini-dissertation makes two main contributions to the existing literature. Firstly, it documents the theoretical and empirical challenges to monitoring and analysing the macro-financial system of South Africa. This is motivated by substantial gaps within the literature regarding the measurement, analysis and monitoring of systemic default risk following the crisis. While Akinboade and Makina (2009) and Fourie, Botha and Mears (2011) find South African credit extension to be procyclical, this study, like Bernstein, Raputsoane and Schaling (2016), finds evidence of credit countercyclicality. Therefore, this study aims to fill the gap by analysing the nature and behaviour of credit extension as a source of systemic risk in South Africa.

Secondly, this study considers the changing nature of the post-crisis global and domestic transmission mechanisms, with a focus on the implications of global spill-overs for South Africa. This is motivated by the growing literature on the implications of co-moving cross-border capital flows for national financial systems. With the combined evidence of a global financial cycle and growing post-crisis EMDE debt levels, the analysis in this study provides important insights into the mechanisms and magnitudes that underlie post-crisis international monetary policy spill-overs to South Africa. Additionally, to the best of the author's knowledge, this study is the first to explicitly compare the co-movement between the global financial cycle and a comprehensive measure of the South African financial cycle using a DFM framework.

Therefore, the results of this study help to inform policymaking regarding improved measurement of the systematic component of domestic default risk and its exposure to international financial frictions.

The rest of the paper is organised as follows. First, the literature review is presented to contextualise the problem by discussing the relationships between external debt, domestic and global financial frictions and national policy implications. Next, the methodology is presented as a roadmap for empirical analysis to determine the driving forces behind the South African financial cycle. Following this, the empirical results are presented and discussed. Specifically, the co-movement between the South African credit and business cycle is analysed. Next, the South African financial cycle is presented and decomposed to determine the contribution of each financial sector in driving common movements. Then, to disentangle common global from idiosyncratic effects, the co-movement between the South African financial cycle, the global financial cycle and VIX is analysed. Finally, policy recommendations are presented, and conclusions are made.

# Literature Review

## EMDE Debt and External Factors

### The role of international factors in domestic debt accumulation

Since the 2007/2008 global financial crisis, low global interest rates and risk premiums have managed to sustain relatively low debt service costs for the rapid pace of debt accumulation in EMDEs (Didier & Schmukler, 2014; Didier, Llovet Montanes & Schmukler, 2016; Love, Martinez Pería & Singh, 2016; Miranda-Agrippino & Rey, 2018; World Bank, 2018). While rising debt levels may be reflective of improved capital market deepening, the role of external forces in determining the nature and composition of domestic EMDE debt has also increased over the period. Specifically, excessive external debt exposure may affect banks' balance sheets and willingness to supply credit.

As an asset, debt tends to strengthen banking solvency, which allows increased credit extension at a relatively higher average cost. As corporate[7] and public sector liabilities, however, debt tends to reduce the value of collateral and weaken balance sheet fundamentals. Moreover, rising corporate debt may influence public finances through larger off-balance sheet liabilities.[8] Weaker public sector balance sheets then add pressure to national budgets and borrowing requirements, which may result in sovereign downgrades. The potential long-run impact is lower aggregate real investment and higher aggregate financing costs.

At this point, one may argue that the lower risk premium of bond financing has supported the rapid increase in debt issuances since the crisis. While longer average maturity does reduce premiums, vulnerability to negative shocks depends on the nature of balance sheet fundamentals and bond investors. Since 2009, increased dispersion of bond investors has appeared to raise the proportion of risky corporate debt issues, despite distress indicators such as falling interest coverage ratios (Feyen, Fiess, Zuccardi Huertas & Lambert, 2017; World Bank, 2018). Moreover, EMDEs' corporate sector leverage has become increasingly concentrated among large domestic industrial firms, which may cause distortions and amplify systemic risks that only become noticed during subsequent contractions (Desai, Foley & Forbes, 2008).

Additionally, large industrial firms tend to exhibit procyclical behaviour, which may negatively affect bank losses and weaken fiscal revenues. During contractions, rising industrial sector unemployment tends to decrease credit demand while raising default risks. Rising unemployment and declining fiscal revenues then place additional pressure on social spending and the borrowing requirement. This can lead to longer, more protracted downswings, which may become more complicated once external dimensions are considered.

Recent literature reveals the growing role of external factors in driving the procyclicality of domestic banking sector leverage (Ayala, Nedeljkovic & Saborowski, 2017; Beltran,

[7] While the discussion focuses on corporate private sector credit due to the rapid increase in EMDEs over the post-crisis period, the transmission mechanisms are assumed to work in a similar manner for households as part of the private sector (SARB, 2018; World Bank, 2018).
[8] Studies on EMDE debt dynamics have found a strong positive relationship between implicit liabilities and state-owned enterprises (SOEs), which has resulted in sharp increases for both debt classes (World Bank, 2018).

Garud & Rosenblum, 2017; Byrne & Fiess, 2016; Chow, 2015; Feyen, Ghosh, Kibuuka & Farazi, 2015). Specifically, stress tests on EMDE corporates show the importance of external debt through the negative effect of exchange rate shocks on interest coverage ratios. Moreover, large firms with high proportions of external debt are found to be more sensitive to changes in debt service costs. All else being equal, domestic currency depreciations tend to increase the value of unhedged foreign currency liabilities, which then raises balance sheet fragility.

Therefore, external debt has become associated more with balance sheet fragilities through mismatches in foreign currency liabilities and assets. Despite such findings, empirical evidence reveals that increases in post-crisis EMDE foreign currency debt have not been driven by nominal currency valuations (World Bank, 2018). This then raises questions about the driving forces behind external debt accumulation. Specifically, what drives domestic credit procyclicality and to what degree is it influenced by external factors?

## The Financial Cycle: A Domestic Perspective

### Characterising domestic macro-financial procyclicality

The degree of domestic credit procyclicality has been studied extensively over time within the context of boom and bust cycles (Adrian & Shin, 2010a; Bernanke, Gertler & Gilchrist, 1999; Besomi, 2006; Borio, 2012; Borio *et al*., 2001; Brunnermeier & Sannikov, 2014; Daníelsson, Shin & Zigrand, 2004; Gertler & Bernanke, 1995; Kashyap & Stein, 2004; Kindleberger, 2009; Kiyotaki & Moore, 1997; Minsky, 1982). While post-war studies initiated the approach of directly relating financial movements to business cycle fluctuations, it was Kiyotaki and Moore (1997) and Bernanke *et al*. (1999) who formalised the financial accelerator framework, which focuses on the presence of endogenous financial frictions.

Specifically, the model explains how balance sheet changes may directly affect economic fluctuations through the asymmetric information between borrowers and lenders. The concept of procyclicality is explained by characterising financial frictions as the cost of an endogenously determined finance premium. While there currently is no consensus definition of the financial cycle, it generally refers to the effect of this procyclicality on macro-financial fluctuations. It refers to the propensity of financial frictions to amplify business cycle fluctuations through changes in financing constraints

(proxied by credit), perceptions of value (proxied by asset prices), and risk assessment (Adrian & Shin, 2010b; Borio, 2012; Borio *et al*., 2001; Daníelsson *et al*., 2004; Drehman *et al*., 2012; Kashyap & Stein, 2004; Ng, 2011).

As a result, there are several ways to characterise the financial cycle. Based on several studies, a close association exists between disproportionate growth in credit aggregates and systemic risk build-up (Aikman *et al*., 2015; BCBS, 2010; Dell'Ariccia, Igan, Laeven & Tong, 2016; Goodhart & Tsomocos, 2011; Jorda, Schularick & Taylor, 2011, 2015; Schularick & Taylor, 2012). Therefore, the credit cycle can be used to characterise systemic stress arising from a specific sector of the financial system. This is due to credit performing best among other financial variables as an early warning indicator of financial system stress. The most prominently used single measure characterisation of the credit cycle is the BCBS (2010) private sector credit-to-GDP gap (gap). From the broad perspective of managing credit constraints, the gap reflects the inverse relationship between bank balance sheet risk and bank capital. However, this measure assumes that domestic private sector credit and business cycles are fully aligned and procyclical.

Several empirical studies find financial cycles to be longer and more pronounced than business cycles, with higher amplitudes over medium- to long-term frequencies of eight to 30 years[9] (Aikman *et al*., 2015; Borio, 2012; Drehmann *et al*., 2012; Koopman & Lucas, 2005; Mendoza & Terrones, 2012; Terrones *et al*., 2011). Moreover, the empirical literature concerning credit procyclicality appears to be mixed, with Angelini, Neri and Panetta (2014), Helbling, Kose, Otrok and Huidrom (2011), Jorda *et al*. (2011), Repullo and Saurina (2011) and Schularick and Taylor (2012) finding evidence of procyclicality for most AEs, while Bouvatier, López-Villavicencio and Mignon (2014) find procyclicality in Canada, the UK and the USA, but not in Australia, Belgium, France, Finland, the Netherlands, Norway and Spain.

Likewise, while Xu (2012) finds evidence of procyclicality in a combination of 33 AEs and EMDEs, no evidence is found by Bebczuk, Burdisso, Carrera and Sangiacomo (2011) and Drehmann and Tsatsaronis (2014) for a combination of 144 and 53 EMDEs and AEs respectively. Similarly, while Akinboade and Makina (2009) and Fourie *et al*.

[9] Business cycles tend to operate over shorter-term frequencies of one to eight years (Borio, 2012).

(2011) find evidence of procyclicality for South Africa, Bernstein *et al*. (2016) find evidence of countercyclicality, with the South African credit-to-GDP gap increasing during real economic contractions and decreasing during expansions. Therefore, while the credit cycle may be an important factor in identifying systemic risk, more factors may be required to explain the overall procyclicality of the domestic financial system.

While the gap provides the best measure of excessive private sector credit build-ups, it only provides an indirect reflection of system risk. Specifically, the higher the risk to future domestic credit constraints, the lower a country's loss-absorption capacity given current regulatory capital requirements. However, such frictions have tended to play a more significant role in systemic destabilisation when combine with the behaviour of asset prices. Studies have found credit aggregates, property prices and equity prices to provide the most parsimonious characterisation of the financial cycle (Drehmann, Borio & Tsatsaronis, 2011; SARB, 2015; Terrones *et al*., 2011).

However, while credit and equity prices appear to perform best for AEs, credit and exchange rates perform better for EMDEs (Terrones *et al*., 2011). Equity prices tend to perform poorly over the medium term due to higher volatility caused by external or sectoral effects. While this is consistent with the greater susceptibility of EMDEs to currency risk, it implies low responses of equity to changes in the financial cycle. Moreover, such characterisations fail to explicitly capture the effects of changes in risk perception. Therefore, studies have begun including variables such as banking leverage and liquidity, bond prices, credit spreads, interest rates, volatilities and risk premiums (Adrian & Shin, 2010b; Curdia & Woodford, 2010; Domanski & Ng, 2011; Gilchrist & Zakrajsek, 2012; Lown & Morgan, 2002; Poledna, Thurner, Farmer & Geanakoplos, 2014; Terrones *et al*., 2011).

By including changes in terms of access to financing and risk attitudes, this measure represents the closest approximation of the general definition of the financial cycle. However, it fails to explicitly capture exchange rate movements, which are potentially significant for EMDEs. Moreover, the domestic financial system is made up of an interconnected network of domestic and external sectors that evolve and respond to the current economic environment and policies within it (Borio, 2012; Kabundi & Mbelu, 2017; Oet *et al*., 2012). Therefore, a more comprehensive approach to characterising the financial cycle may include representations of the entire financial

system. One such approach is based on the idea of a financial conditions index (FCI) that includes credit, asset, funding, foreign exchange and global market variables.

FCIs are designed to provide a summary measure of domestic macro-financial conditions. This is done by capturing the common movements among a broad set of variables that influence economic behaviour (Hatzius *et al*., 2010; Kabundi & Mbelu, 2017). Therefore, Domanski and Ng (2011), Hatzius *et al*. (2010) and Kabundi and Mbelu (2017) use FCIs to characterise domestic macro-financial conditions by combining a variety of financial price and quantity variables into a single informative index. Apart from credit and asset prices, variables included in an FCI generally range from banking sector leverage and liquidity indicators to credit spreads, exchange rates and commodity prices. By including global commodity prices and currency fluctuations, FCIs explicitly attempt to capture global effects that may influence domestic macroeconomic conditions. Moreover, by including variables that capture terms of access to financing and risk attitudes, FCIs can be used as a close approximation of the general definition of the financial cycle.

Together with Austrian theory dynamics, FCIs can be used to characterise the financial cycle by common systematic forces that reflect the interactions between capital accumulation and financial decisions (Borio *et al*., 2001; Schumpeter, 1939). While such forces are assumed to be inherent in economic processes, there is no consensus on how they drive systematic risk over the business cycle. From the perspective of a closed system with financial accelerator frictions, the systematic component may be assumed to be a function of several common and idiosyncratic factors within the system (Borio & Lowe, 2002; Farrell & Kemp, 2017; Kabundi & Mbelu, 2017; Miranda-Agrippino & Rey, 2018; Rey, 2013). Specifically, variables can be assumed to respond to common changes that affect the entire system, and to idiosyncratic changes specific to each sector.

Based on the literature, one significant common driving force may be the misrepresentation of credit default risk. Therefore, systematic risk can be characterised by fluctuations in credit default risk, which generally relates to negative states. The general assumption is that actual credit losses rise during downswings, while expected and unexpected losses rise as upswings progress. During downswings, asset prices are assumed to be relatively lower than debt, resulting in an

increased probability of actual defaults. Similarly, the probability of actual loss given default will increase during recessions, especially for debt backed by procyclical collateral. The opposite would be true during upswings, i.e. relatively high asset-to-debt values will increase the probability of expected and unexpected defaults. This is assumed to build up systematically over time, creating significant systemic default risk.

During financial expansions, high asset-to-debt values increase the willingness of banks to extend credit. As collateral values rise, risk tends to be underestimated, which sustains excessive credit growth and the systematic build-up of default risk. Simultaneously, relatively low levels of bank capital may sustain unobserved financial imbalances[10] and real-sector distortions,[11] which then sow the seeds for a subsequent contraction. The opposite would be true during financial contractions, with the realisation of actual defaults reducing assets to debt values. This decreases the willingness of banks to extend credit, as risk tends to be overestimated, potentially resulting in a longer, more protracted contraction. However, the role of cross-border capital flows and changes in global risk aversion may place additional pressure on these endogenous mechanisms.

## The Financial Cycle: A Global Perspective

### Understanding co-movements in global capital flows



The recent crisis has highlighted the importance of global capital movements in creating boom and bust cycles, especially in EMDEs. As mentioned previously, external factors have become more dominant, with empirical studies finding significant co-movements among cross-border credit growth, asset prices and leverage flows over time (Bekaert, Hoerova & Lo Duca, 2010; Bruno & Shin, 2015b; Byrne & Fiess, 2016; Daníelsson *et al*., 2004; Ehrmann, Fratzscher & Rigobon, 2011; Fratzscher, 2012; Igan, Kabundi, De Simone, Pinheiro & Tamirisa, 2011; Miranda-Agrippino & Rey, 2018; Morais, Peydro & Ruiz, 2015; Nier *et al*., 2014; Rey, 2013; Shin, 2012; Terrones *et al*., 2011). This phenomenon of co-moving global capital flows has become known as the global financial cycle.

[10] "Financial imbalances" refer to the growing fragility of private sector balance sheets that is driven by, but also feeds into, unsustainable economic expansions (Borio & Drehmann, 2009). They are associated with more persistent risk-taking during benign economic conditions, with a higher likelihood of widespread macro-financial instability.
[11] Such as misaligned investment.

Based on a structural interpretation of its negative relationship with the CBOE VIX, the global financial cycle may be regarded as a measure of aggregate volatility and time-varying risk aversion in global financial markets. By construction, the VIX represents a measure of implied market volatility that reflects the aggregate degree of economic uncertainty and risk aversion. Measured by the implied volatility of S&P 500 index options, the VIX is often used to capture the degree of financial market strain based on investor uncertainty and risk aversion. Studies by Bruno and Shin (2015b), Cerutti *et al*. (2017), Forbes and Warnock (2012), Fratzscher (2012),Miranda-Agrippino and Rey (2018) and Rey (2013) all find a strong negative linear relationship between various global capital flows and the VIX. By contrast, Nier *et al*. (2014) find a conditional non-linear relationship for EMDEs, with the VIX appearing to become dominantly negative only during periods of high global uncertainty and risk aversion. While the effect may be conditional for EMDEs, this relationship does have significant implications for global leverage, credit growth and asset pricing.

The global financial cycle may be characterised by the investment preferences and constraints of leveraged global banks and asset managers by including its negative relationship with the VIX in a theoretical model of heterogeneous investors (Adrian & Boyarchenko, 2018; Adrian & Shin, 2014; Brunnermeier & Sannikov, 2014; Bruno & Shin, 2015a; Etula, 2013; Lane & McQuade, 2014; Miranda-Agrippino & Rey, 2018; Reinhart & Reinhart, 2009; Rey, 2013; Zigrand, Danielsson & Shin, 2009). When global banks and asset managers become the main investors, the asymmetric interaction between their combined preferences and constraints tends to reduce risk aversion and premiums[12] over time. On the one hand, value-at-risk (VaR) constrained global banks are assumed to be risk-neutral, implying a strong incentive for massive risk-taking and leveraging. On the other hand, standard mean-variance asset managers exhibit positive degrees of risk aversion, which limits their desire to leverage.

All things being equal, low risk aversion tends to relax the VaR constraint, leading to increased bank borrowings. This tends to increase global asset demand and narrow lending spreads, which then places upward pressure on the global financial cycle (with

[12] The risk premium is assumed to be dependent on the wealth distribution between leveraged global banks and asset managers, such as insurance companies, sovereign wealth funds or pension funds (Miranda-Agrippino & Rey, 2018).

the opposite being true during periods of high risk aversion). Therefore, a self-reinforcing feedback loop may arise through the cross-border lending behaviour of global banks, with excessive risk-taking leading to domestic financial instability. This is confirmed by several studies that find strong cross-border transmission of financial instability from AEs to EMDEs through banking and other financial crises (Balakrishnan, Danninger, Elekdag & Tytell, 2011; Byrne & Fiess, 2016; Eichengreen, 2000; Kabundi & Mbelu, 2017; Laeven & Valencia, 2013; Park & Mercado, 2014; Reinhart & Rogof, 2009).

EMDEs tend to be long in US government debt (assets) and short in equities (liabilities). Therefore, balance sheets during crisis periods tend to be characterised by relatively stable or increasing assets, with decreasing liabilities. As investors in AEs respond to financial shocks with significant capital outflows, EMDEs with large external liabilities tend to experience substantial losses (Balakrishnan *et al*., 2011; Broner, Gelos & Reinhart, 2006). Moreover, based on the "volatility paradox", rising asset prices may mask unsustainably expanding global bank balance sheets, which may weaken EMDE balance sheets (Brunnermeier & Sannikov, 2014; Miranda-Agrippino & Rey, 2018). Therefore, by signalling domestic balance sheet solvency and liquidity problems, the global financial cycle may create self-fulfilling investor expectations.

With the US dollar being the currency of global banking, one may begin to question the role of US monetary policy in influencing the cost of global funding, the price of US-denominated external assets, and the provision of global credit. Specifically, global banks may be able to transmit US monetary policy shocks to domestic financial systems through the global financial cycle (Miranda-Agrippino & Rey, 2018; Morais *et al*., 2015; Shin, 2012). Testing this relationship, Miranda-Agrippino and Rey (2018) and Rey (2016) find strong evidence of powerful US monetary policy spill-overs through the global financial cycle.

Using a large Bayesian VAR, Miranda-Agrippino and Rey (2018) find an unexpected tightening of the US federal funds rate to result in short-term real US contraction and dollar appreciation. As risk aversion rises over the medium term, US bank balance sheets contract, with reductions in domestic and international borrowing and leverage. This reduces global asset demand and prices, which raises global risk aversion and risk premiums. The global financial cycle then enters a downswing, as term spreads

narrow and the global external finance premium rises. Extending this analysis[13] by considering the effects on national balance sheets in an environment with US-denominated foreign debt, Rey (2016) finds that dollar appreciation tends to depreciate the domestic currency, resulting in an increase in the value of the US-denominated balance sheet debt.

Taking it a step further, expanding domestic bank balance sheet assets could stimulate domestic borrowing despite a recessionary environment. While this may provide an explanation for countercyclical credit cycles, it does suggest strong evidence of US monetary policy effects in potentially driving domestic procyclicality through the global financial cycle. Therefore, if US monetary policy changes represent a potential determinant of domestic financial cycles, current levels of EMDE debt may be explained by protracted depressed post-crisis global rates rather than underlying country-specific structural vulnerabilities (BIS, 2015). Moreover, it presents important challenges to standard international macro-financial theory.

In an environment with large foreign balance sheet debt, domestic monetary policy faces a conflict between output and balance sheet stabilisation (Rey, 2016). Therefore, despite a floating exchange rate, the interest rate cannot be used alone as a policy tool to manage the prevailing conflict. Governed by the eponymous Mundellian trilemma theory, standard international macroeconomics assumes that policymakers face three desirable, though jointly unattainable, objectives: exchange rate stability, free capital mobility and nationally independent monetary policy (Obstfeld, Shambaugh & Taylor, 2005). This implies that floating exchange rates under liberal capital regimes[14] are incapable of exporting monetary policy from the centre country to the periphery (Fleming, 1962; Miranda-Agrippino & Rey, 2018; Mundell, 1963; Rey, 2016). However, with the presence of external balance sheet debt, the trilemma morphs into a ‘dilemma’, with the interest rate becoming a blunt tool.

This challenges the assumption that dynamic monetary conditions can be shaped by the single use of a short-term policy rate. If this were true, the marginal freedom from exchange rate flexibility would be sufficient to neutralise any potential global spill-over

[13] Rey (2016) follows the methodology of Gertler and Karadi (2015), who use an augmented VAR with high frequency identification (HFI) to test the response of credit costs through term premiums and credit spreads to monetary policy shocks.
[14] Including the assumption of uncovered interest parity (UIP).

effects. Despite implying a strong invalidation of the trilemma theory, the model remains an important guideline for understanding the true severity of policy constraints. Therefore, the benevolent and prudent policymaker must consider any additional policy conflicts within the context of changes to external foreign currency balance sheet debt.

## Macroeconomic Policy Implications

### National alternatives to global transmission management

Based on the above discussions, financial vulnerabilities tend to build up over time and reflect the self-reinforcing interaction between the financial and real sector. While a closed system with credit market frictions may explain a portion of domestic procyclicality, it is not sufficient to generate large waves of instability, which tend to become systemic. By extending FA models to include the role of international frictions, empirical studies have shown a growing role for international credit and risk-taking frictions in domestic credit procyclicality (Eichengreen, 2001; Kose, Otrok & Whiteman, 2003; Miranda-Agrippino & Rey, 2018; Obstfeld, 2009; Rey, 2016; World Bank, 2018). This provides evidence of the strength of cumulative processes in generating common risk factors, which will become more important as risks of faster paced US interest rates and dollar appreciation increase a decade after the crisis

This raises questions of how monetary policy should incorporate financial objectives within its mandate to promote macroeconomic stability. While some authors argue for the explicit inclusion of a financial target within standard Taylor rule models, empirical studies have only shown minor deviations from standard models (Adrian & Shin, 2009; Agénor & Silva, 2013; Albulescu, Goyeau & Pépin, 2013; Baxa, Horváth & Vašíček, 2013; Carlstrom, Fuerst & Paustian, 2010; Castro, 2011; Christiano, Motto & Rostagno, 2014; Curdia & Woodford, 2010; Issing, 2011; Ma & Zhang, 2016; Mishkin, 2011; Woodford, 2012).

Therefore, a substantial body of literature promotes the use of macroprudential measures to supplement traditional monetary policy (Aoki, Benigno & Kiyotaki, 2016; BCBS, 2010; Caruana, 2010; Farhi & Werning, 2016; Gameiro, Soares & Sousa, 2011; Liu & Molise, 2016; SARB, 2016; White, 2009; Woodford, 2012). While Smets (2014), Svensson (2012) and Ueda and Valencia (2014) argue that dual objectives tend to reduce credibility, establishing clear and uniform policy rules may overcome

the time-inconsistency problem by sustaining credibility. Therefore, policymaking tends to incorporate financial objectives through a framework directed towards improving the measurement and management of macro-financial stability.

Macroprudential policy represents one such framework, specifically designed to strengthen the financial system while limiting potential systemic risk (SARB, 2016). Consequently, it involves two broad components: identifying systemic risks and using various instruments to manage these risks. On the one hand, this requires a definite conceptualisation of systemic financial risk for the purpose of appropriate measurement and monitoring. On the other hand, it requires instruments that can reduce the potential of systemic risk while improving systemic resilience to unwanted shocks (Adrian *et al*., 2015; BCBS, 2010; Borio, 2012; Caruana, 2010; Karmakar, 2016; Liu & Molise, 2018; SARB, 2016).

Prior to the 2007/2008 global financial crisis, the optimal macroprudential policy involved addressing financial vulnerabilities before they became systemic. Rather than waiting to correct the effects of financial instability, policymakers assumed that 'pricking the bubble before it burst' would adequately supress any unwanted outcomes. However, this is based on the perception that financial vulnerabilities are easily identified and can be controlled with a single instrument: the nominal interest rate (Blanchard, Dell Ariccia & Mauro, 2010). With the role of financial procyclicality in masking the systemic vulnerabilities that led to the 2007/2008 crisis, macroprudential policy has evolved with a stronger focus on taking advantage of potentially destabilising imbalances. As such, macroprudential instruments are now guided by the philosophy of building up provisions during upswings that may be drawn down during downswings. Known as 'leaning against the wind', this approach focuses on leaning against cyclical amplifications to build up provisions that can then be used to reinforce the system against negative shocks.

Therefore, instruments are designed to strengthen the macro-financial system against negative aggregate shocks while simultaneously leaning against financial imbalances that tend to amplify the financial cycle. Therefore, successful macroprudential policy involves identifying systemic risks and using instruments based on building up provisions during good times that may be drawn down during bad times, i.e. 'leaning against the wind' (Borio, 2012; Erdem & Tsatsaronis, 2013). This requires the

combination of four types of policy responses focused on the build-up of systematic risk from common domestic and global movements: (1) improved risk measurement; (2) a set of supervisory rules; (3) a set of supervisory instruments; and (4) the complementary use of monetary, fiscal and macroeconomic policy.

### (1) Improved risk measurement

Generally defined as the likelihood of system-wide financial destabilisation, systemic risk comprises both cyclical and structural risk. While cyclical risk refers to the time dimension of systematic risk,[15] structural risk refers to the cross-sectional concentration within the financial system that may propagate cyclical risk. Therefore, the goal is to find measures that can capture both current and expected vulnerabilities based on cyclical risk. As previously discussed, the BCBS (2010) credit cycle represents one such measure of cyclical risk. Calculated as the deviation of the credit-to-GDP ratio from its long-term trend, the cycle is extracted using a one-sided Hodrick-Prescott (HP) filter with a smoothing parameter of 400 000[16] (BCBS, 2010; Drehmann & Tsatsaronis, 2014; Giese, Andersen, Bush, Castro, Farag & Kapadia, 2014). Despite extensive use, Drehmann and Tsatsaronis (2014), Farrell (2016) and Hamilton (2017) argue that the gap lacks formal economic specification.

Using a one-sided filter implies a backward-looking (recursive) trend, which only takes information up to the end point into account. This is shown to result in artificially generated trends and cycles with future values that are forecasted from lagged values. This assumes that financial variables should follow an unpredictable random walk, while most tend to be non-stationary (Hamilton, 2017; Miranda-Agrippino & Rey, 2018). To overcome this problem, Hamilton (2017) suggests an alternative approach that redefines the HP cyclical component according to the Beveridge and Nelson (1981) characterisation. By assuming stationarity within a non-finite (rather than finite) forecast horizon, the cycle may be extracted from the actual data-generating cyclical factors from several financial variables.

[15] Cyclical risk also includes a non-systematic (idiosyncratic) component that is specific to each variable or sector in the financial system; however, the focus of this study is on the common factors that propagate the correlation among variables.
[16] Normally, the smoothing parameter is set to 1 600 for quarterly data, for no methodological reason.

Another approach that can be used involves redefining the trend, rather than the cyclical component. Using an unrestricted (UR) Morley, Nelson and Zivot (2003) correlated unobserved components (UC) model, Grant and Chan (2017) modify the HP trend as a second-order Markov (2M) process with a drift. Grant and Chan (2017) demonstrate the flexibility of the UCUR-2M model in allowing for both time-varying trend growth and reducing the assumptions required for cyclical generating processes. Alternatively, Farrell and Kemp (2017) use a multivariate UC time series model (TSM) to estimate the South African financial cycle. Based on the statistical approach of Harvey and Trimbur's (2003) UCTSM, Farrell and Kemp (2017) use the Kalman filter to extract the trend and cyclical components from the series. By modelling the trend and cycle as UCs within a structural TSM framework, this approach implicitly defines filters that are consistent with the data. Moreover, UCTSMs overcome the end of sample problem by automatically adapting to the end of the sample (Harvey & Trimbur, 2003).

While these approaches represent significant measurement improvements, further research is required to provide stronger empirical justification over the HP filter. For example, the main difference between Grant and Chan's (2017) UCUR-2M model and the HP filter is a slightly more persistent gap at some cost to fitness. Moreover, the significant difference between filtering techniques and the UCTSM model used by Farrell and Kemp (2017), is the end-of-sample problem. Therefore, despite some shortcomings, the standard HP filter remains one of the strongest empirically tested methods for characterising cyclical risk, especially for systemic stress arising from individual sectors.

### (2) A set of supervisory rules

Next, policymakers need to establish a set of supervisory rules aimed at cyclically limiting the sources of systematic risk build-up, i.e. excessive credit and leverage growth (Borio *et al*., 2001; Rey, 2013). These could either be mechanically designed to respond to risk measures like the credit gap, or more judgement-based, such as balance sheet stress testing. Currently, the BCBS (2010) uses the credit gap as a common reference guide for implementing the mechanically based countercyclical capital buffer (CCB). While such rules tend to remain relatively immune to political lobbying, the mechanism relies heavily on the assumption of credit procyclicality.

As previously discussed, failure of this assumption to hold results in credit countercyclicality, which implies increasing capital requirements during downswings, while decreasing them during upswings. Therefore, mechanical application of rule-based measures may end up amplifying the build-up of a crisis. Rather than discarding such measures, this provides strong justification for the supplementary use of judgement-based measures (BCBS, 2010; Drehmann & Tsatsaronis, 2014; Farrell, 2016; Liu & Molise, 2018; SARB, 2011; Van Vuuren, 2012). One option is either broad-based or more targeted financial sector balance sheet stress-testing. With a strong focus on financial accelerator transmission, stress tests involve large simulations that assess whether changes in financial variables pose a significant threat to financial stability. Despite the unpopular requirement of regular reporting and complementary fiscal credibility, regular stress tests have the advantage of revealing potential weaknesses in areas such as corporate governance (Rey, 2013).

### (3) A set of supervisory instruments

Selecting policy instruments involves addressing the various sources of systematic risk build-up arising from common movements in variables like banking sector capital, leverage, liquidity, maturity mismatches or global balance sheet linkages (Rey, 2013; SARB, 2016). With that in mind, Basel III has designed an arsenal of instruments that fall into three general categories: capital-based, asset-side and liquidity-based instruments.



*Capital-based Instruments*

The most prominent capital-based instrument based on banking sector solvency is Basel III's CCB. CCBs are designed to ensure adequate capital levels to maintain the flow of credit during periods of systemic stress (BCBS, 2010; Bernstein *et al*., 2016; Liu & Molise, 2018). As previously mentioned, activation is based on an automatic rule that uses a threshold to determine whether increases (or decreases) in minimum capital requirements are necessary. During upswings (downswings), this involves potentially raising (lowering) capital requirements to influence the cost of bank capital and supply of credit. While the CCB has strong advantages in its ability to overcome

optimism bias[17] while building up provisions, it may result in the unnecessary build-up of excess capital reserves.

Vallageas (2013) challenges the appropriateness of capital requirements by stressing the distinction between deposit banks (which create money) and other financial entities (which do not). The mechanics of capital requirements come from the assumption that bank capital is crucial for securing liabilities. While this might be true for non-financial industrial firms, it may not be true for money-creating institutions. Therefore, Vallageas (2013) argues that bank capital is effectively redundant, with excessive build-ups leading to systemic securitisation like that which led to the recent crisis. While this argument highlights the risks of excessive capital build-ups, it may be overcome by improved timing of policy activation administered by designated disciplinary boards.

To that end, macroeconomic policy has made a major step in developing Twin Peaks regulatory structures comprising designated authorities for market and prudential control respectively (South African National Treasury, 2018; SARB, 2015). Following Australia, the Netherlands, the UK and Canada, South Africa has adopted a Twin Peaks regulatory framework through the Financial Services Regulation Act No. 9 of 2017. Specifically, the Act aims to support financial stability through specific authorities that manage market risk and prudential policy separately. Replacing the Financial Services Board, the Financial Sector Conduct Authority (FSCA) focuses on managing business conduct and consumer protection. Operating through the SARB, the Prudential Authority (PA) focuses on managing financial stability. Therefore, with strong regulatory structures in place, capital-based instruments provide strong policy alternatives.

*Asset-side Instruments*

Given the relationship between credit and asset prices, Basel III has designed the leverage ratio (LR) as a non-risk-based instrument to restrict excessive balance sheet lending. Measured as the proportion of capital exposure to both on- and off-balance sheet items, higher (lower) LR ratios than a certain threshold during upswings (downswings) result in increased (decreased) capital requirements, especially for large off-balance sheet exposure. Additionally, instruments such as loan-to-value

[17] Bias towards inaction when good times are unfolding, and everyone is happily sharing the dividends of increasing asset returns, forgetting about the risk building up (Rey, 2013).

(LTV) and debt-to-income (DTI) ratios may be used. However, unlike the LR, these measures may be subject to biases such as reporting standards and tax incentives (Rey, 2013).

Another promising instrument developed by Drehmann and Juselius (2012) focuses on capturing joint credit, property price and interest rate dynamics to estimate the risk of relative debt unsustainability. By assuming that a given lending rate equates debt service costs[18] to maturity, economy-wide debt service ratios (DSRs) are measured by the proportion of aggregate private sector fixed debt service costs to GDP. While DSR ratios may be appropriate for targeted vulnerabilities, further research is required from the perspective of systematic risk effects.

*Liquidity-based Instruments*

To protect the banking sector against potential liquidity outflows during periods of financial stress, Basel III proposes the countercyclical liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR). Specifically, these ratios measure the proportion of high-quality credit and liquidity assets that are needed to cover net liquidity outflows during specific time periods of stress (BCBS, 2013, 2014). While the LCR focuses on improving short-term liquidity resilience by matching liquid assets to outflows, the NSFR focuses on longer term resilience by requiring more stable sources of funding on an ongoing structural basis. Given the consequences manipulating the liquidity shortage, these instruments are advisable only when specific vulnerabilities exist.



*Alternative Instruments*

A growing body of literature has begun to consider the practical implementation of alternative tools, such as equity inflow taxes and macroprudential stability levies. Using a model with nominal rigidities, market incompleteness and foreign currency debt, Farhi and Werning (2016) find taxing foreign currency debt to be an optimal macroprudential tool, especially for EMDEs. Moreover, leverage caps on forex derivatives and taxes on non-core forex liabilities have proven efficient for EMDEs with certain country-specific dynamics (Chamon & Garcia, 2016; Farhi & Werning, 2016; Forbes, Fratzscher, Kostka & Straub, 2011; Rey, 2013). Given the changing dynamics

[18] Calculated as interest and repayments.

of aggregate cross-border debt flows in EMDEs, further research on country-specific benefits and costs of such instruments would be highly valuable.

## (4) The complementary use of monetary, fiscal and macroeconomic policy

Any consideration of macroprudential policy implementation should involve an assessment of the viability of monetary and fiscal policy measures as complementary tools (Borio *et al*., 2001; Rey, 2013). To the extent that procyclicality stems from inappropriate risk responses, the scope for application should remain within the context of national macroeconomic policy, and instruments chosen on the basis of addressing specific vulnerabilities.

*Monetary Policy*

Empirical literature testing the Mundellian trilemma theory tends to focus on co-movements between domestic and centre-country policy rates across exchange rate regimes. Monetary independence is then proven by low or no co-movement between the two policy rates. However, while short-term policy rates tend to be less correlated under floating regimes when capital is freely mobile, this does not provide sufficient proof of autonomy in an environment with foreign debt (Goldberg, 2013; Klein & Shambaugh, 2015; Obstfeld, 2015; Obstfeld *et al*., 2005; Rey, 2016).Therefore, policy tightening or foreign currency intervention may remain applicable under certain circumstances.



While monetary policy is less effective in mitigating balance sheet recessions,[19] it may be used to support balance sheet repair through exchange rate depreciation (Borio, 2012; Rey, 2016). When debt is not dominated by foreign currency, reduced reserves or foreign currency sales may temporarily boost output and cash flows. However, it may be perceived to have beggar-thy-neighbour connotations and result in unwelcome exchange rate and capital flow pressures, especially among commodity-exporting EMDEs. Therefore, policymakers should pay close attention to the changing composition of external foreign currency-denominated debt in domestic banking sector balance sheets.

[19] When the private sector is overly indebted, monetary policy is less likely to be an effective tool for stimulating balance sheet recessions (Borio, 2012).

Alternatively, policymakers may consider the controversial use of capital controls to insulate domestic financial movements from global spill-overs. While there is no consensus regarding the effect of permanent controls, temporary controls on cross-border credit and portfolio debt have proven effective where large cross-border leverage occurs in unsustainable asset markets (Rey, 2013). Since macroprudential policies may weaken the link between domestic monetary policy and capital flows without any controls,[20] temporary targeted capital controls should rather be viewed as a partial substitute for severe crisis episodes.

*Fiscal and Macroeconomic Policy*

Ideally, effective macroprudential policy involves the reduction of buffers during recessions that were built up during economic expansions. During upswings, temporary restrictive fiscal measures could be used to contain the optimism bias associated with overstating potential output estimates. Failure to implement such measures may require using public sector balance sheets to support banking sector balance sheet repair. While the main fiscal policy challenge involves avoiding a sovereign crisis, healthy public finances could be used to establish a self-sustaining economic recovery during recessionary periods (Borio, 2012). However, highly indebted public finances should prioritise crisis management to avoid additional pressure on systemic risk.



Since large fiscal deficits can amplify global spill-over effects, policymakers require reforms that help reduce domestic procyclicality and increase resilience to potential global shocks (Frankel, 2017; World Bank, 2018). This could be done by realigning public spending towards growth-enhancing investments and managing the changing composition of external debt. This may stabilise public debt levels and ease tax burdens by generating additional fiscal revenues. Therefore, fiscal policy choices should be guided by overarching macroeconomic policy that aims to establish long-term fiscal sustainability (Callen *et al*., 2014; Halland, Noel, Tordo & Kloper-Owens, 2017; Hesse, 2008; Mendes & Pennings, 2017; World Bank, 2018).

Given the expected changes in global demand, resource-rich commodity-exporting countries should consider macroeconomic policy guided by export diversification to

[20] Specifically, all else being equal, a domestic tightening coupled with sound macroprudential policy should reduce the external finance premium.

improve longer term growth and resilience to global shocks. Resource revenues can then be reallocated towards well-managed strategic investment funds (SIFs) that create investment opportunities, deepen capital markets, and build state capacity as a professional long-term investor. However, such policies should be complemented by additional measures that foster human and physical capital development, improve institutional governance and enhance regional competitiveness.

Taken together, the literature suggests a growing role for external balance sheet debt in determining the procyclicality of domestic financial cycles. While consensus exists regarding the presence of a distinct domestic financial cycle, the question of appropriate characterisation remains open. Despite some methodological challenges, the credit-to-GDP gap remains the strongest empirically tested measure of systemic risk emanating from private sector imbalances. However, the most comprehensive measure appears to involve the combination of a set of variables that characterise the entire financial system.

Moreover, distinguishing between phases of the domestic financial cycle and its relationship to the business cycle is crucial for informing the selection and use of macroprudential policies. Policies may function differently depending on the relationship between the two cycles, with macroprudential tools becoming less effective during corresponding downswings, especially when credit is countercyclical. Understanding this relationship becomes more pertinent with growing evidence of a global financial cycle that may partly transmit US monetary policy to national financial systems. Therefore, policymaking requires an improved understanding of the determinants of domestic financial cycles. Specifically, the degree to which common domestic and global movements interact and potentially affect the amplification of real cycles through the systematic build up of risk needs to be analysed.

# Methodology

The aim of this section is to provide a roadmap for analysing the determinants of the South African financial cycle. As mentioned earlier, the goal of this study is to investigate whether the South African financial cycle is isolated from global financial frictions. If not, we may be able to infer that rising domestic public sector debt levels may partly be attributed to post-crisis changes in global monetary policy. Based on the

literature, this requires insight into the *systematic components of risk* that may generate *systemic risk*. While a general description of systemic risk is sufficient for the literature, a more detailed description is required for empirical analysis.

Following Borio *et al*. (2001) and De Bandt and Hartmann (2000), this study empirically defines *systemic risk* as the source-independent credit default risk that is faced by the entire domestic macro-financial system. The general assumption is that financial frictions are partly driven by aggregate perceptions of credit risk that arise from changes in asset values and financing constraints. This may cause build-ups of default risk by perceived nominal balance-sheet strength masking real financial distress. Therefore, systemic risk is characterised by build-ups of default risk during boom phases that are reflected by actual defaults during recessions. As discussed later, stronger positive correlations during downswings would provide evidence of credit procyclicality and a strong role for credit market frictions in generating significant systemic risk.

If the credit and business cycles are not fully aligned, countercyclicality would provide strong evidence that systemic risk may be driven by other factors that influence the cyclical component of risk. Therefore, following Borio *et al*. (2001) and Diamond and Dybvig (1983), this study empirically defines *systematic risk* as source-dependent risk driven primarily by forces that are common to the entire domestic macro-financial system. Given an open-economy framework, international diversification is assumed to reduce any remaining effects to residual and idiosyncratic (non-systematic).



As mentioned in the previous section, there is no consensus on how these forces are assumed to drive the build-up of systematic risk over the business cycle. This is primarily due to empirical difficulties in defining cyclical movements, such as turning points or timing recessions (Aikman *et al*., 2015; Drehmann *et al*., 2012; Terrones *et al*., 2011). Based on the literature, three general approaches can be used to characterise a domestic cycle: turning-point approach, filtering techniques and factor-analysis models.

The turning point method is used to date the National Bureau of Economic Research (NBER) business cycles by identifying cyclical movements from the growth rates (trend deviation) of a set of variables (Ahking, 2014; Harding & Pagan, 2002). Pattern-

recognition techniques[21] are used to derive turning points that condense the movements into a single reference cycle subject to a set of censoring rules.[22] Filtering techniques such as the HP filter, discussed in more detail below, use statistical filters to detrend the series and isolate cyclical patterns (Drehmann *et al*., 2012; Phillips & Jin, 2015). Despite wide empirical use, the statistical formalisation of both approaches tends to characterise financial cycles as unpredictable transitory shocks. While this may be appropriate for testing systemic procyclicality, it is not appropriate for characterising systematic risk build-up. Therefore, a third approach uses factor models to extract and decompose movements based on the systematic build-up of time-varying cyclical risk.

Within this framework, systemic risk is assumed to have a systematic component, which is a function of several stochastic risk factors[23] that are common to the system, and an idiosyncratic component that is specific to various sectors within the system. For a given set of properties, the correlations between these factors can be defined as the sensitivity of each to the systematic (common) component and represented by factor loadings. Specifically, the factors are assumed to follow stochastic mean-reverting processes, with loadings representing the response of each to common systematic movements characterised by well-defined, time-varying sequencing rather than an unpredictable random walk.



Recall from the literature review that this study concentrates on one specific factor, which can be thought of as credit (leverage) default risk. The main implication of mean reversion is that the (conditional) probability of a downswing increases with the forecast horizon when the cycle is above trend.[24] Assuming a normal probability distribution, this allows the time dimension of credit risk to be characterised by the relationship between asset prices and credit losses.[25] This relationship has significant implications for the interpretation of factor loadings and correlations within the model.

[21] Such as graphical or visual observation, or more commonly used algorithms like the Bry and Boschan (BB) algorithm.
[22] A set of rules that re-combine the turning points to satisfy pre-determined criteria concerning the duration and amplitudes of phases and complete cycles (Harding & Pagan, 2002).
[23] Stochastic properties describe a type of mathematical rule that governs the probability of movement of time-series variables.
[24] This implication holds irrespective of the causal mechanisms behind the cycle.
[25] This arises from the conceptual definition of credit losses: the probability of default (credit risk) or loss given default (asset-to-debt risk).

Firstly, the assumption of more persistent mean-reverting credit losses implies a loading premium during recessions. During downswings, when asset prices are relatively lower than debt, the probability of defaults (reflected by high factor loadings) will be high. Similarly, loss given default would increase, with asset values closer to insolvency for debt backed by procyclical collateral. Secondly, the conditional probability[26] of default risk implies higher correlations of credit losses during recessions. Therefore, this implies higher correlations among expected and unexpected losses, reflected by higher asset price volatility and default probability. The opposite would be true during upswings i.e. low factor loadings and correlations. With that in mind, this study conducts the analysis in two stages: (1) measuring the domestic credit cycle as source of systemic risk and (2) measuring the domestic financial cycle as a measure of common systematic risk build-up.

## The Domestic Credit Cycle as Source of Systemic Risk

### Modelling the South African credit cycle

Following the BCBS (2010), Bernstein *et al*. (2016), Borio (2012), Drehmann *et al*. (2011), Farrell (2016), Giese *et al*. (2014) and Ng (2011), this study characterises domestic credit market frictions using the aggregate private sector credit-to-GDP gap as a measure for capturing *systemic risk* arising from private sector movements. As a methodology, the HP filter represents a smoothing method that extracts cyclical fluctuations from time series data (Drehmann *et al*., 2012; Phillips & Jin, 2015). Frequencies are then identified by a tuning (smoothing) parameter that is defined by the expected average duration of the cycle.

The filter can be viewed as decomposing the time series $y_t$ into a smooth trend meant to capture the long-run growth, $\tau_t$, and a residual cyclical component, $c_t$, with a frequency determined by the smoothing parameter $\lambda$:

$$y_t = \tau_t + c_t \quad (1)$$

[26] The probability of one default conditional on another is assumed to be a decreasing function of credit quality.

The trend is then calculated by solving an optimisation problem chosen to minimise the sum of squared deviations of $y_t$ from $\tau_t$, plus the sum of squared second differences weighted by $\lambda$:

$$\tau_t = \underset{\tau_t}{argmin}\{\sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=1}^{T}(\Delta\tau_t - \Delta\tau_{t-1})^2\} \quad (2)$$

While the first summation penalises poorness of fit, the second summation penalises lack of smoothness through $\lambda$, which weights the variation in $\tau_t$. It is assumed that, as $\lambda \to 0$, the trend converts to the series $y_t$; however, as $\lambda \to \infty$, $\tau_t$ produces a series with a second difference of exactly zero (Hamilton, 2017). Therefore, the selection of lambda is critical in characterising the frequency of the cyclical component.

While lambda is typically chosen as $\lambda$ = 1 600 for quarterly time series, the empirical literature supports the use of 400 000 for capturing long-term trend behaviour (Drehmann & Tsatsaronis, 2014; Ravn & Uhlig, 2002). Since credit variables tend to have longer average cycle durations and frequencies, higher values of lambda are more appropriate. Moreover, Borio and Lowe (2002) and the BCBS (2010) find $\lambda$ = 400 000 to perform best in capturing private sector indebtedness. Therefore, this study will use a one-sided Hodrick-Prescott (HP) filter with the smoothing parameter $\lambda$ set to 400 000.



## The Domestic Financial Cycle as a Measure of Systematic Risk

### Modelling the South African financial cycle

Following Hatzius *et al*. (2010), Igan *et al*. (2011), Miranda-Agrippino and Rey (2018), Ng (2011) and Stock and Watson (2016), this study uses a dynamic factor model (DFM) to characterise the systematic build-up of credit default risk in the South African financial system. As discussed previously, factor models assume that the common dynamics of several variables are driven by a few latent (unobservable) factors. The cyclical component is extracted by exploiting these co-movements and weighting each according to the similarity of common fluctuations. Therefore, each factor is assumed to exhibit a mean-reverting structure determined by an idiosyncratic component specific to each sector, and a common systematic component irrespective of sector.

Following the literature, this can be expressed by a $N \times 1$ vector of observed time series variables $Y_t = (y_{1t}, y_{2t}, \dots, y_{Nt})'$, dependent on a common component $X_t = (x_{1t}, x_{2t}, \dots, x_{Nt})'$ and an idiosyncratic component $E_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{Nt})'$:

$$Y_t = X_t + E_t \tag{3}$$

where $Y_t$ represents a collection of stationary demeaned variables chosen to represent the entire macro-financial system. $X_t$ is assumed to be driven by a small number of unobservable ($F_t$) factors that are common to $Y_t$ and orthogonal to $E_t$, which is assumed to be driven by sector-specific factors. Therefore,

$$Y_t = AF_t + E_t, \tag{4}$$

with $F_t = (f_{1t}, f_{2t}, \dots, f_{kt})'$ comprising a vector of contemporaneously orthogonal $k$ number of common factors loaded by an $N \times k$ matrix, $A = (a'_1, a'_2, \dots, a'_N)'$, representing the coefficients (loadings) that determine the reaction (sensitivity) of each to the common factors. Therefore, the matrix $A$ is used to weight the systematic variation among factors $(f_t)$ with the common movement captured by $F_t$. By construction, $k \ll N$, with $F_t$ and $E_t$ allowed to exhibit weak cross-sectional correlation (Chamberlain & Rothschild, 1982; Hatzius *et al*., 2010; Igan *et al*., 2011; Stock & Watson, 2016).



By applying the law of large numbers ($N, T \longrightarrow \infty$), the system can then be modelled by estimating $F_t$ as the first principal component of $X_t$. Through cross-sectional averaging, principal component analysis (PCA) removes the idiosyncratic component $E_t$, and minimises the sum of square deviations of the common component from the individual factors ($min_{(A)(F_t)} \sum_{t=1}^{T} (F_t - A'F_t)(F_t - AF_t)$). The problem is solved by calculating the first $k$ eigenvalues and eigenvectors from the sample variance-covariance matrix, $Cov(X_t)$, defined as:

$$AF_t = X_t = VV'Y_t \tag{5}$$

Since the factor loadings $A$ represent the variance $V$, the equation can be written as:

$$F_t = X_t = V'Y_t \tag{6}$$

Following Forni, Giannone, Lippi and Reichlin (2009), Igan *et al*. (2011), Miranda-Agrippino and Rey (2018) and Ritschl, Sarferaz and Uebele (2016), this study uses an approximate dynamic specification with the assumption that the common factors and idiosyncratic terms are zero-mean processes characterised by lagged finite dependence. DFMs form part of a class of hidden Markov models that specify the evolution of latent factor dynamics, $F_t$, as lagged $VAR\ (p)$ process:

$$F_t = \Phi_1 F_{t-1} + \cdots + \Phi_p F_{t-p} + \upsilon_t, \tag{7}$$

with a collection of autoregressive coefficients $(\Phi_1, \ldots, \Phi_p)$ in a $k \times k$ matrix $\Phi$, and normally distributed error term $\upsilon_t$.[27] The idiosyncratic component, $E_t\ (i.e. Y_t - X_t)$, is then assumed to capture any residual autocorrelation through a collection of independent univariate AR processes,

$$E_t = \rho E_{t-1} + \eta_t, \tag{8}$$

with $\eta_t \sim i.i.d.N(0, \sigma_N^2)$ and $\mathbb{E}(\eta_t, \eta_s) = 0$. Based on an initial value of $F_0$, the common movement in $F_t$ can then consistently be estimated up to a scale by summing over the squared loadings from the first $k$ principal component solutions. Therefore, the number of factors ($k$) requires specification. While the empirical determination remains an open question, several approaches exist,[28] with the most widely used being the Bai and Ng (2002) information criteria (IC).



Information criteria are used to penalise an objective function by creating a trade-off between the cost of increased sampling variability and the benefit of an additional parameter. Extending this idea, Bai and Ng (2002) propose an estimate of $k$ that minimises the objective function (equivalent to the maximised mean $R^2$) subject to a penalty function that increases with $k$, such that:

$$IC(k) = lnV\left(k, \hat{F}_t\right) + kg(N, T), \tag{9}$$

with $lnV\left(k, \hat{F}_t\right)$ representing the objective least-squares minimisation function and $g(N, T)$ the penalty function for overfitting. Since $g(N, T)$ vanishes at a rate that does

[27] Also assumed to follow a zero-mean process
[28] See Stock and Watson (2016) for a discussion of alternative approaches.

not permit under- and over-parameterisation, efficiency is maintained,[29] as $k$ is chosen to best capture the variations in $X_t$ that estimate the loadings. By generalising the $C_p$ criteria of Mallows (1973), Bai and Ng (2002) specify the penalty, $C_{NT} = \{\sqrt{N}, \sqrt{T}\}$, as a function of both $N$ and $T$. Assuming that $\hat{\sigma}^2$ is a consistent estimate of $V(k, \hat{F}_t)$, it then becomes the required penalty-scaling term implied by the logarithmic transformation of the objective function, represented as:

$$IC_{p1}(k) = lnV\left(k, \hat{F}_t\right) + k\left(\frac{N+T}{NT}\right)\ln\left(\frac{NT}{N+T}\right)$$

$$IC_{p2}(k) = lnV\left(k, \hat{F}_t\right) + k\left(\frac{N+T}{NT}\right)\ln C_{NT}^2$$

$$IC_{p3}(k) = lnV\left(k, \hat{F}_t\right) + k\left(\frac{lnC_{NT}^2}{C_{NT}^2}\right).$$

Along with the first $k$ eigenvalues (arranged in decreasing order) of the variance-covariance matrix, the above criteria will then be used to select the appropriate number of factors to include within the analysis.

## Data and Data Transformations

### The South African aggregate private sector credit-to-GDP gap

Calculated as the deviation of the private sector credit-to-GDP ratio from its long-term trend, the credit-to-GDP gap is used to capture excessive credit movements relative to economic growth. Following the BCBS (2010), the broad measure of total credit extended by all monetary institutions to the domestic private sector is used to allow for the inclusion of all sources of private credit. The ratio is then calculated using nominal GDP, as follows:

$$Ratio_t = \left({Credit_t}/{GDP_t}\right) \times 100\%.$$

Both variables are nominal, seasonally adjusted prior to calculation and taken in quarterly frequency over the period 1980Q1 to 2016Q4. The gap is then calculated as

[29] Efficiency is lost when more factor loadings are estimated (Bai & Ng, 2002).

the deviation of the ratio from its long-term trend using the HP filter as described above, and decomposed as follows:

$$GAP_t = Ratio_t - Trend_t,$$

with $Trend_t$ representing the long-run sustainable average of the credit-to-GDP ratio and $GAP_t$ representing the medium-term cyclical component. As discussed previously, credit extension is assumed to be procyclical, therefore the expectation is for the gap to increase during business cycle upswings and decrease during downswings. This will be judged by comparing the gap to SARB business cycle dates and the correlation coefficient to the South African business cycle. Following Bernstein *et al*. (2016), the business cycle is proxied by the South African coincident indicator and calculated with quarterly averages, using the HP filter with the standard smoothing parameter for quarterly data of 1 600.

## The South African financial cycle

Following the literature, the financial cycle will be constructed using 12 financial variables that influence economic behaviour, capture risk sentiment and fall within the six main sectors of the financial system: credit, equity, real estate, foreign exchange, funding, and global (Hatzius *et al*., 2010; Kabundi & Mbelu, 2017; Ng, 2011; Oet *et al*., 2012). Additionally, the real sector will be incorporated using the single-measure real GDP as a macroeconomic variable (Borio, 2012; Drehmann *et al*., 2012). Below is a brief description of variables in each sector, while a complete list of variables, sources and treatment are included in Appendix Table A.



### *Credit Market*

The credit market is captured by three variables: the private sector credit[30]-to-GDP ratio, term spread (government bonds 10 years and over – 0 to 3 years), and corporate bond spread (Eskom bonds – government bonds 0 to 3 years). Unlike the 'gap', which is more sensitive to structural changes such as financial deepening, the 'ratio' captures excessive credit movements relative to GDP while assuming a constant long-term trend in the relationship (Drehmann *et al*., 2012). Lending spreads are used to capture

[30] Public-sector debt is excluded from the analysis due to its countercyclical behaviour (Drehmann *et al*., 2012).

the degree of credit market risk as the economy's average cost of borrowing[31] (Drehmann et al., 2012; Miranda-Agrippino & Rey, 2018). The expectation is that financial cycle upswings are characterised by low default risk. This should be evidenced by narrow credit spreads, and rising credit relative to GDP.

*Asset Market*

The asset market includes both the equity market and the real estate market. The equity market is represented by equity prices, the SAVI and bank volatility. Equity prices are captured using the IMF IFS South African Share Price Index.[32] The SAVI and the JSE financials volatility indexes are used to capture the aggregate degree of market-risk aversion. The expectation is that financial upswings should be characterised by low default risk aversion, reflected in low equity price volatility. However, equity prices tend to perform poorly over the medium term due to higher volatilities (Borio, 2012; Drehmann *et al*., 2012; Giese *et al*., 2014). Therefore, this study includes a measure of the real estate market to capture movements in general asset prices. The real estate market is captured by the ABSA house price index, with the expectation of rising asset to credit reflected by low house price volatility (Terrones *et al*., 2011).

*Funding Market*

The funding market is represented by the South African JIBAR, banking sector leverage and M2 money supply.[33] JIBAR will be used to measure the cost of liquidity by the average cost of raising short-term funds in the banking sector (Drehmann *et al*., 2012). Banking sector leverage is calculated as the ratio of total bank assets to total bank equity and is used to capture the risk of excessive on- and off-balance sheet leverage (BCBS, 2017). Drawing from a more neoclassical relationship, real money growth is included to capture changes in broad money supply. The expectation is that, during an upswing, low default risk evidenced by high assets to equity will lower liquidity costs and raise money supply.

[31] Lending spreads may additionally be used as a policy anchor tool that seeks to smooth out funding costs (Drehmann *et al*., 2012).
[32] The SARB JSE All Share Index only has data from 1985, while IMF IFS data covers the full sample.
[33] CDS spreads were initially considered as a measure of banking sector funding risk; however, it was excluded due to bias caused by a high correlation with the cumulated factor.

*Foreign Exchange Market*

The forex market is included to account for exchange rate frictions and represented by the real effective exchange rate (Borio & Lowe, 2002). The expectation is that upswings are characterised by currency appreciations reflecting capital inflows, and low degrees of currency mismatch risk. If capital flows reflect rising credit inflows and lowering values of external debt, this could provide evidence of global frictions affecting the domestic cycle.

*Global Market*

Finally, global commodity prices are used to explicitly capture changes in global demand. As a commodity-exporting EMDE, the South African financial cycle is expected to be influenced by changes in global commodity prices. Following Miranda-Agrippino and Rey (2018) and Rey (2016), the expectation is that domestic financial cycle upswings are characterised by high domestic GDP sustained by rising commodity prices. This reduces domestic default risk and lowers global risk aversion. This should be reflected in a rising financial cycle, with rand appreciation implying dollar depreciation and decreasing values of external debt. To provide evidence of this transmission mechanism, this study will examine the correlation between the constructed South African financial cycle and the global financial cycle and VIX respectively.



This study will use the Miranda-Agrippino and Rey (2018) measure of the global financial cycle and the CBOE VIX collected from the Federal Reserve Bank of Saint Louis Economic Database (FRED). All other data is collected from the SARB, INET BFA and IMF IFS (Appendix Table A). All series are taken at quarterly frequency using end-of-quarter values spanning the period 1980Q1 to 2016Q4 to provide a sufficiently long sample to extract medium-term cycles. The series are deflated (where necessary) using the South African consumer price index, and seasonally adjusted[34] and natural logarithms are used.[35] Prior to estimation, all series are tested for unit roots and standardised by subtracting the mean and dividing by their respective standard deviations.

[34] X-12 was used for removing the seasonal component of the series.
[35] Except for those series expressed in percentages.

### Unit root tests

Due to the unrealistic assumption of stationarity for most financial variables, the degree of integration is tested, and the series are transformed where necessary by differencing (Hamilton, 2017; Igan *et al*., 2011; Kabundi & Mbelu, 2017; Miranda-Agrippino & Rey, 2018). Equation (4) is then transformed by $\tilde{y}_t \equiv \Delta y_t$ denoting the first difference of any variable $Y_t$:

$$\tilde{y}_t = A\tilde{F}_t + \tilde{E}_t$$

The ERS unit root test and the KPSS unit root test will be used to test stationarity, with the ERS test used as a more powerful, generalised least-squares test and a null hypothesis of non-stationarity I(1). The KPSS test is then used as a robustness check, with a null hypothesis of stationarity I(0). Due to the tendency of time series data to exhibit a strong trend, the tests are carried out including both a constant and a deterministic trend[36] (Igan *et al*., 2011). The Schwarz information criteria are used to select the number of lags, ensuring limited remaining serial correlation in the residuals. The results of unit root tests are presented in Appendix Table B.

# Empirical Results

Based on the models presented in the previous section, this section proceeds to investigate the determinants of the South African financial cycle to determine whether it is isolated from global financial frictions or not. Firstly, domestic credit procyclicality is analysed to determine the contribution of private sector credit to generating systemic risk. This will provide insight into whether or not the South African financial cycle is driven by factors common to the entire system.

Next, financial system procyclicality is analysed to disentangle common from idiosyncratic movements in driving the systematic build-up of credit default risk. Periods of excessive build-up will be determined over the sample period. This will be decomposed to determine (a) the response of each variable to changes in the common factor, and (b) the share of each variable's contribution in driving common movements. The main driving forces are then analysed to determine whether common global

[36] In cases of doubt, the analysis was repeated by excluding the trend and/or the constant from the null hypothesis (Igan *et al*., 2011).

factors may play a role in determining common domestic movements. This will be done by comparing the correlations between the South African financial cycle, the global financial cycle, and CBOE VIX. This will help to determine the degree of common versus idiosyncratic global movements in driving the systematic build-up of domestic credit default risk. Following the methodology, the analysis is presented in two sections: (1) the South African credit cycle and (2) the South African financial cycle.

## The South African Credit Cycle

### Private sector credit market frictions as a source of systemic risk

As a measure of *systemic risk* arising from common private sector market frictions, Figure 1 presents the South African credit cycle over the period 1980 to 2016. Measured by the private sector credit-to-GDP gap, positive values above 0 imply above average build-ups of credit default risk, characterised by rising private sector credit extension. As discussed previously, rising credit extension is assumed to generate systemic risk through the build-up of credit default risk. Similarly, falling credit extension is assumed to reflect the realisation of this risk evidenced by actual credit defaults.

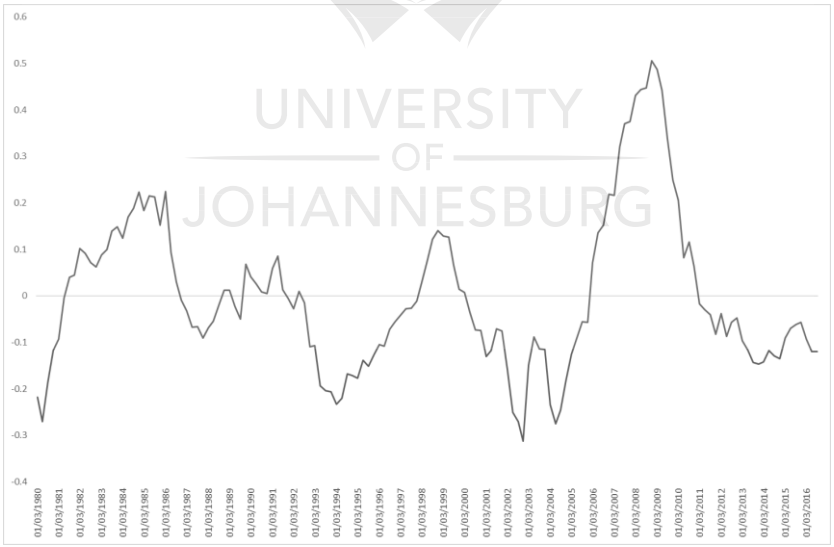


Figure 1: South African aggregate private sector credit-to-GDP gap, 1980 to 2016

Since 1980, South Africa has seen four periods of above-average private sector credit extension, with the gap widening from 1981 to 1986, 1988 to 1992, 1998 to 2000 and from 2006 to 2011. The first rise in credit extension appears to have been driven by the international gold price boom of the early 1980s. Despite relatively tight monetary policy, increases in gold and foreign reserves lowered the expected default risk, which

supported excess bank liquidity and credit extension (SARB, 1981). Peaking after four years, the credit cycle began turning, primarily due to actual defaults caused by the rapidly declining gold price (SARB, 1984).

The next rise in above-average credit extension, from 1988 to 1992, was characterised by structural and regulatory changes in the funding sector. While banks were increasing their penetration into the mortgage loan market,[37] policy shifts in the Deposit-Taking Institutions Act created increases in balance sheet deposits and assets[38] (SARB, 1988, 1991). Peaking after two years, the credit cycle began decreasing, with defaults being realised due to low investor confidence caused by socio-political instability at the time.

Coinciding with the Asian financial crisis (AFC), the third period, from 1998 to 2000, was characterised by firms switching from foreign to domestic sources of financing due to relative rand weakness at the time (SARB, 1999). Despite domestic monetary tightening, low default risk was further reinforced by capital market deepening and corporate restructuring during the time. While not evidenced in the credit cycle, the South African economy did not escape the spill-over effects from the AFC. In fact, it was the AFC that first revealed signs of the potential negative consequences of increased financial globalisation and the power of changing global market sentiment.



While the turn of the millennium saw a decreasing gap, this occurred primarily due to regulatory changes concerning the reporting practices of corporate sector investment in derivatives (SARB, 2000). Nevertheless, following the global trend at the time, the South African credit cycle widened from 2006 to 2011 due to falling risk perception driven by rising asset values, primarily in the housing market. Once again displaying insensitivity to a tightening cycle in interest rates, the willingness of South African banks to extend credit increased to its highest level over the sample period. As securitisation entered the credit market during the lead-up to the crisis, rising asset prices propelled significant build-ups of private sector credit risk.

Peaking in 2009, the South African credit cycle began responding to global liquidity concerns as systemic levels of actual credit defaults tightened global and domestic

[37] While the mortgage loan market was dominated by mutual building societies, commercial banks began providing more flexible mortgage loans to consumers (Verhoef, 2017).
[38] Off-balance sheet items being recorded as conventional deposits and assets.

funding markets and raised debt-service costs (SARB, 2009). Along with risk mispricing, these results provide strong evidence for global and regulatory (structural) market changes being significant determinants of private sector credit movements in South Africa. However, this does not provide evidence of credit procyclicality.

The correlation between the credit gap and South African business cycle is presented in Figure 2. As discussed previously, stronger, more positive correlations during downswings would provide evidence of procyclicality, with a strong role for credit market frictions in amplifying business cycle fluctuations. With an overall correlation coefficient between the two series of -0.360, it is evident that the South African credit cycle is weakly countercyclical. This suggests that the South African business cycle may lead aggregate private sector credit growth. Table 1 shows the SARB business cycle dates from January 1978 to the end of the sample, bearing in mind that the null of procyclicality is rejected by an increasing gap during real downswings.

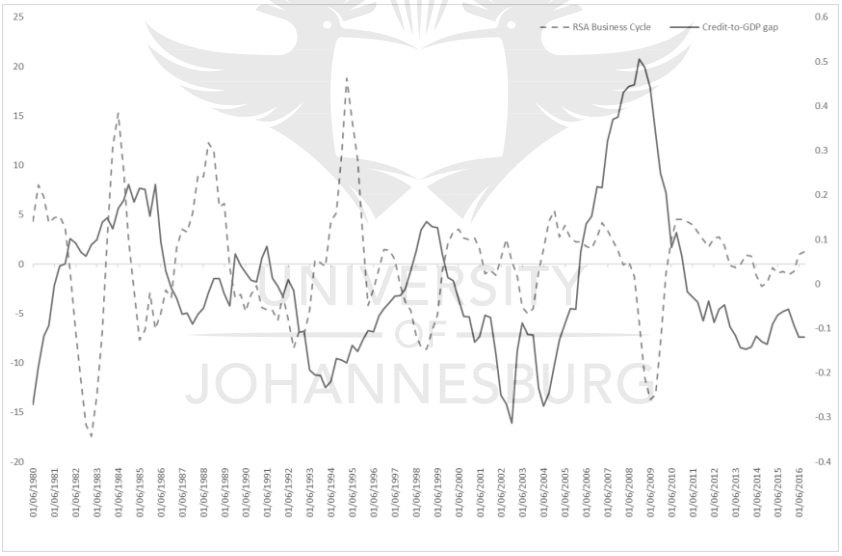


Figure 2: The South African business cycle and credit-to-GDP gap, 1980 to 2016

Note: The South African business cycle is proxied by the South African coincident indicator. The SARB constructs the coincident business-cycle indicator by combining various equally weighted indicators of economic activity, including aggregate production, sales, income and employment indicators (Bernstein *et al*., 2016). The correlation coefficient between the two series is -0.360.

While the credit gap was widening during the early 1980s, the business cycle was in a downward phase, interrupted only briefly by the short spending boom of 1983/1984. Despite real contraction from 1981 to 1986, credit extension continued to rise, driven primarily by increases in corporate sector overdrafts to finance involuntary inventory accumulation and supplement cash flows during the recession (SARB, 1984). The second credit gap increase, from 1988 to 1992, appears to coincide with an economic

downswing from 1989 to 1993, characterised by the previously discussed structural changes at the time. The third period, from 1998 during the AFC, coincides with an economic downswing from December 1996 to August 1999. Finally, despite higher lending rates and a business cycle downswing from 2007 to 2009, South African private sector credit extension rose significantly leading up to the GFC.

Table 1: South African business cycle dates: 1978 to 2016

| Upward phase | | Duration in quarters | Downward phase | | Duration in quarters |
|---|---|---|---|---|---|
| Jan 1978 | Aug 1981 | 15 | Sept 1981 | Mar 1983 | 6 |
| Apr 1983 | Jun 1984 | 5 | Jul 1984 | Mar 1986 | 7 |
| Apr 1986 | Feb 1989 | 12 | Mar 1989 | May 1993 | 17 |
| Jun 1993 | Nov 1996 | 14 | Dec 1996 | Aug 1999 | 11 |
| Sept 1999 | Nov 2007 | 33 | Dec 2007 | Aug 2009 | 7 |
| Sept 2009 | Nov 2013 | 17 | Dec 2013 | Dec 2016* | 12 |

Source: (SARB, 2017b)
* End of sample date

In contrast to what is expected, the South African credit cycle appears to be weakly countercyclical, with a relatively low and negative correlation with the business cycle. This result is consistent with Bouvatier *et al*. (2014) and Repullo and Saurina (2011) for AEs, Drehmann and Tsatsaronis (2014) across a panel including EMDEs, and Bernstein *et al*. (2016) for South Africa, who all find cases of domestic credit countercyclicality. One potential explanation for this phenomenon may lie within the lead-lag relationships between the two variables in question, namely private sector credit and output. Specifically, studies find empirical evidence of credit cycles lagging output cycles, especially during economic contractions (Igan *et al*., 2011; Repullo & Saurina, 2011).

During business cycle downswings, reduced cash flows may continue to stimulate private sector credit demand – through households attempting to smooth out consumption or businesses attempting to finance inventory accumulation (Gertler & Bernanke, 1995; Koivu, 2009). With higher credit relative to slower (or negative) GDP growth rates, this result may be amplified by the specification of how the credit-to-GDP gap is calculated. Specifically, using deviations of the credit-to-GDP ratio from its long-term trend may increase the time it takes for the gap to return to average levels. Therefore, while financial accelerator theory assumes that credit market frictions amplify (and therefore lead) business cycle fluctuations, this may not be true for South

Africa. However, this can only be confirmed empirically by examining the lead-lag relationship between domestic credit and output.

## The South African Financial Cycle

### Systematic credit risk as a source of systemic risk

As a reflection of systematic default risk arising from common movements in the entire system, Figure 3 presents the South African financial cycle from 1980 to 2016. As discussed previously, the macro-financial system is represented by 13 variables (see Appendix Table A) chosen to represent six interconnected sectors: credit, equity, real estate, funding, forex, and global markets. A DFM is used to capture the financial cycle using Bai and Ng's (2002) PC and IC criteria to determine the number of factors required to represent the common movements behind changes in systematic risk build-up. The outcome for the number of common factors is presented in Table 2.

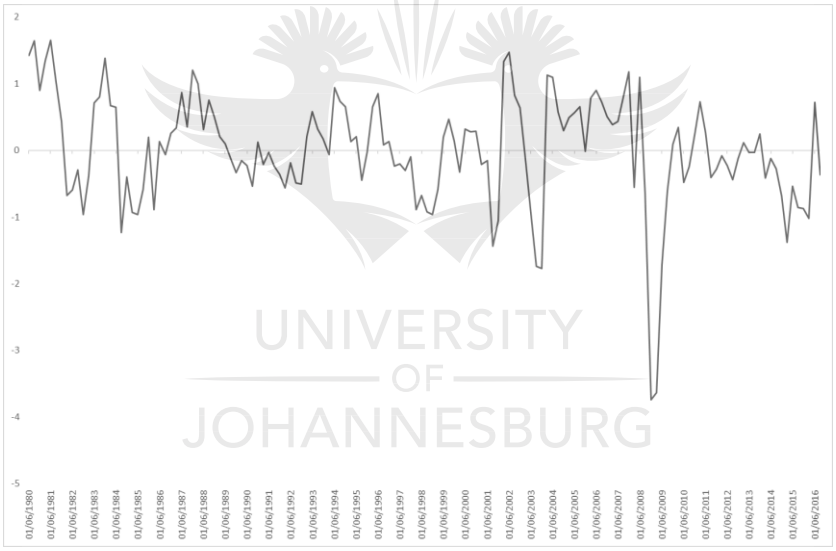



Figure 3: The South African financial cycle, 1980 to 2016

Based on the results, the largest eigenvalue alone accounts for only 22% of the common variability in the data, with the IC criteria failing to converge with a maximum of 10 factors. Given the lack of convergence with the appropriate number to include, the number of factors was chosen based on the cumulative variance explained, using nine factors selected at a 10% level of significance. Each of the nine factors was then weighted by its corresponding eigenvalue and cumulated into a single factor by summing the factors over the sample period. Factor loadings were then obtained using a regression equation for each variable, with the single factor as the independent variable.

Since the factor is standardised and assumed to represent the perception of credit (leverage) default risk, it is consistently estimated up to scale with a mean of 0, implying the average level of default risk caused by misperception. Therefore, positive values strictly above 0 may be interpreted as periods of rising default risk characterised by narrow lending spreads, rising credit-to-GDP, low asset price volatility, high banking sector leverage and money supply, low liquidity costs, and currency appreciations driven by rising commodity prices, resulting in higher GDP. Financial cycle downswings imply the opposite.

As is evident from Figure 3, the South African financial cycle experienced six periods of above-average build-ups in default risk, potentially driven by common (mis)perceptions of risk: from 1980 to 1982, 1983 to 1984, 1986 to 1989, 1993 to 1996, 1999 to 2003 and 2004 to 2008. Confirming the effects of the gold price boom, the financial cycle decreased from a peak during the early 1980s, reflecting actual losses incurred from the falling international gold prices at the time. As the gold price decreased, commodity prices decreased, along with South African asset prices and exports, which caused significant capital outflows and rand depreciation. Moreover, as gold and foreign reserves decreased, liquidity risks rose as funding contracted, which resulted in rising domestic credit costs and widening international lending spreads (SARB, 1982).



Table 2: Number of common factors

| $k$ | CUMULATIVE VARIANCE EXPLAINED | $PC_p1$ | $PC_p2$ | $PC_p3$ | $IC_P1$ | $IC_P2$ | $IC_P3$ |
|---|---|---|---|---|---|---|---|
| **1** | 0.2150 | 0.7889 | 0.7892 | 0.7884 | -0.0412 | -0.0341 | -0.0517 |
| **2** | 0.3737 | 0.6405 | 0.6412 | 0.6396 | -0.0594 | -0.0451 | -0.0803 |
| **3** | 0.5035 | 0.5209 | 0.5219 | 0.5195 | -0.0839 | -0.0625 | -0.1152 |
| **4** | 0.6043 | 0.4302 | 0.4314 | 0.4283 | -0.1030 | -0.0744 | -0.1447 |
| **5** | 0.6935 | 0.3508 | 0.3524 | 0.3485 | -0.1508 | -0.1151 | -0.2029 |
| **6** | 0.7601 | 0.2940 | 0.2959 | 0.2912 | -0.1881 | -0.1452 | -0.2506 |
| **7** | 0.8221 | 0.2417 | 0.2439 | 0.2384 | -0.2795 | -0.2295 | -0.3525 |
| **8** | 0.8727 | 0.2008 | 0.2033 | 0.1970 | -0.4061 | -0.3490 | -0.4895 |
| **9** | 0.9164 | 0.1666 | 0.1695 | 0.1624 | -0.6188 | -0.5545 | -0.7126 |
| **10** | 0.9550 | 0.1376 | 0.1408 | 0.1329 | -1.0302 | -0.9587 | -1.1344 |

Note: For each value of $k$ the table shows the cumulative percentage of variance explained by the $k$-th eigenvalue (in decreasing order), the percentage of variance explained by the $k$-th eigenvalue (in decreasing order) and the value of the Bai and Ng (2002) $IC_p$ criteria.

Boosted by the stabilising gold price, the next above-average build-up in risk occurred over the 1983/1984 spending boom. As the gold price rebounded over the period,

expectations for stronger growth appeared to sustain lower expected default losses through increasing gold and foreign reserves and a stabilising currency (SARB, 1989). The third and fourth periods of systematic risk build-up during the late 1980s and early 1990s were driven primarily by high socio-political instability that was driven by risk perception surrounding the democratic transition in South Africa in 1994. While higher than expected default losses drove capital outflows and rand depreciation, the successful implementation of structural adjustment policies appeared to stabilise the economy (SARB, 1997).

Leading up to the AFC during the mid-1990s, systematic risk build-up was reflected by the under-estimation of regional default risk that drove EMDE asset markets and capital inflows. This build-up of risk was realised as the AFC erupted in 1997, characterised by large asset market losses and capital flow reversals. The rand depreciated as rising global risk aversion towards EMDEs stimulated further losses (SARB, 1998). As the global economy rebounded from the AFC, South Africa successfully attracted significant capital inflows over the early millennium period, from 1999 to 2003 (SARB, 2001). As domestic equities outperformed Wall Street, under-estimation of default risk drove international investment towards domestic corporate bonds. Moreover, government bond yields fell substantially as credit rating upgrades sustained lower perceptions of default risk.

Despite rising asset and commodity prices sustaining the low perceptions of default risk, a massive rand depreciation in 2001 caused significant losses that only stabilised in 2003 (SARB, 2005). As a possible continuation of the millennial systematic build-up of default risk, the most recent upswing leading up to the 2008/2009 crisis appears to have been driven primarily by rising global asset prices. From 2004 to 2008, capital inflows were driven by a combination of strong commodity prices and low global risk aversion due to rising asset relative to debt values. As inflows were channelled towards rising domestic asset, house and equity prices, government bond yields fell as further credit rating upgrades boosted aggregate credit extension (SARB, 2007).

While this cursory overview provides some insight into the South African financial cycle, the aim of adopting a composite measure is to investigate the determinants of common movements in driving systematic risk build-up. To this end, Table 3 presents the factor loadings and variance share decomposition of common movements based

on each variable's contribution. As discussed previously, factor loadings represent the sensitivity (response) of each variable to movements in the common factor (risk perception), with higher loadings reflecting higher default probability. The variance share shows the contribution of each variable in driving changes in risk perception, with higher correlations reflecting higher probabilities of expected and unexpected losses. Moreover, while positive loadings indicate variables that increase with financial cycle expansion, negative loadings represent variables that increase during contractions.

The estimates in Table 3 offer a few important insights into the co-movement of risk perception in propagating the South African financial cycle. Firstly, banking sector leverage, lending spreads, equity prices, commodity prices and money supply each account for more than a 95% share of common movements in risk perception. This implies that the South African financial cycle is driven mainly by common systematic changes in risk perception arising from frictions in the funding, credit, equity and global markets.

Secondly, GDP, commodity prices and short-term interest rates have the highest factor loadings. This implies that real output, the global and short-term funding markets have the highest sensitivity to changes in the common factor. Stated more precisely, these sectors respond the most to common systematic changes in risk perception. Next, banking sector leverage and private sector credit have the lowest factor loadings, implying the lowest response to changes in the common factor. Finally, banking sector leverage, bank volatility and the SAVI have negative loadings, implying that these variables increase during financial cycle downswings.

Taken together, the South African financial cycle represents the common systematic build-up of risk driven by the funding, credit, equity and global markets. Upswings (build-ups) emanate from low banking sector leverage risk driven by rising on- and off-balance sheet debt assets relative to debt equity. This lowers the probability of default, which stimulates corporate bond issues and narrows spreads. Equity and commodity price volatility decrease as capital is redirected towards debt and credit markets that sustain growing money supply. As government bond issues rise and the term spread narrows, the cycle appears to be propagated by strong positive responses in economic growth and global commodity demand and monetary policy easing.

Table 3: Factor loadings and variance share decomposition of the common component

| Variables | Factor loadings | Variance share of common component |
|---|---|---|
| Leverage ratio | -0.041 | 0.985 |
| Corporate bond spread | 0.110 | 0.973 |
| Equity prices | 0.188 | 0.969 |
| Commodity prices | 0.464 | 0.966 |
| Aggregate money | 0.265 | 0.952 |
| Term spread | 0.191 | 0.952 |
| JIBAR | 0.423 | 0.922 |
| Bank volatility | -0.207 | 0.906 |
| Real GDP | 0.581 | 0.901 |
| House prices | 0.368 | 0.881 |
| Exchange rate | 0.225 | 0.850 |
| Private sector credit | 0.094 | 0.844 |
| SAVI | -0.280 | 0.813 |

Note: Based on the cumulative variance explained in Table 2, nine factors were cumulated into one single standardised factor that is assumed to represent the perception of credit (leverage) default risk. Detailed treatment of variables can be found in Appendix Table A. Higher loadings reflect higher sensitivity (response) to common movements in the factor (risk perception). Positive loadings indicate variables that increase during upswings, while negative loadings represent variables that increase during contractions. Higher variance shares reflect higher contributions in driving common movements in risk perception through increased probability (correlation) of expected and unexpected losses.



To confirm this transmission mechanism graphically, Figure 4 represents the variation in each main driving sector over the sample period. Generally, all sectors appear to respond as expected to corresponding upswings in the South African financial cycle. Default risk increases, and lending spreads narrows as expected during all six upswings over the sample. Conversely, money supply volatility increases as expected over all periods from the late 1990s, with unexpected decreases during the upswings over the early 1980s. Equity and commodity price volatility both appear moderate over the early upswing periods, with expected significant reductions in both following the 2007/2008 crisis. However, high equity volatility is seen from 1998 to 2002, following the AFC.

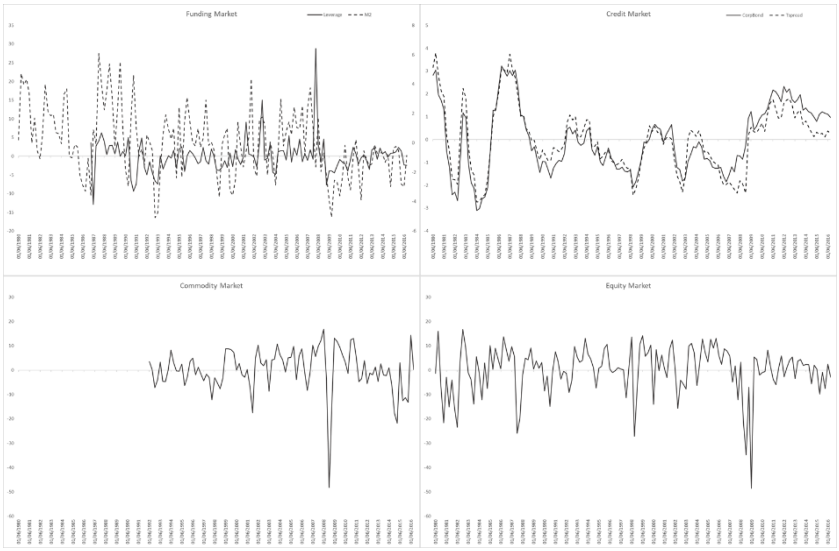


Figure 4: The variation in each main driving force from 1980 to 2016

To provide further insight into the propagation mechanisms, Figure 5 represents the correlation between the South African financial and credit cycles (discussed in the previous section). Confirming the low positive response of 9.4% (see Table 3) to changes in the common factor, the credit and financial cycles have a weak negative relationship. While it may be tempting to justify credit countercyclicality using the correlation coefficient of -0.34 (Table 4), closer inspection reveals that all above-average credit periods coincide with financial cycle upswings, as is expected. Therefore, this relationship is more likely due to the higher frequency of the financial cycle, making it less smooth than the credit cycle.

The credit gap widens during coinciding periods of low (but systematically increasing) default risk, characterised by financial cycle upswings from 1980 to 1998 and leading up to the 2008/2009 crisis. However, over the period 1999 to 2003, while the financial cycle is increasing, the credit gap is decreasing significantly. Together with unexpected equity volatility increases during this period, this may provide evidence of a possible idiosyncratic period from 1999 to 2003. Low money supply volatility in the early 1980s may be explained by the gradual policy shift away from targeting monetary aggregates. However, the case for credit and equity price volatility driven by idiosyncratic forces during the early 2000s is less clear.

As discussed previously, the interaction between credit and asset markets forms a fundamental relationship for capturing the financial cycle. Property prices tend to perform better than equity over the medium term, with the latter being more

susceptible to other factors such as external changes or sectoral influences. This is confirmed by looking at factor loadings in Table 3, with property prices being more sensitive to common cyclical movements (37%), while equity prices show an 88.2% (11.8% to common cyclical movements) responsiveness to idiosyncratic movements. While this provides strong evidence of sectoral or external changes driving equity price volatility, it does not provide insight into periods driven by idiosyncratic movements.

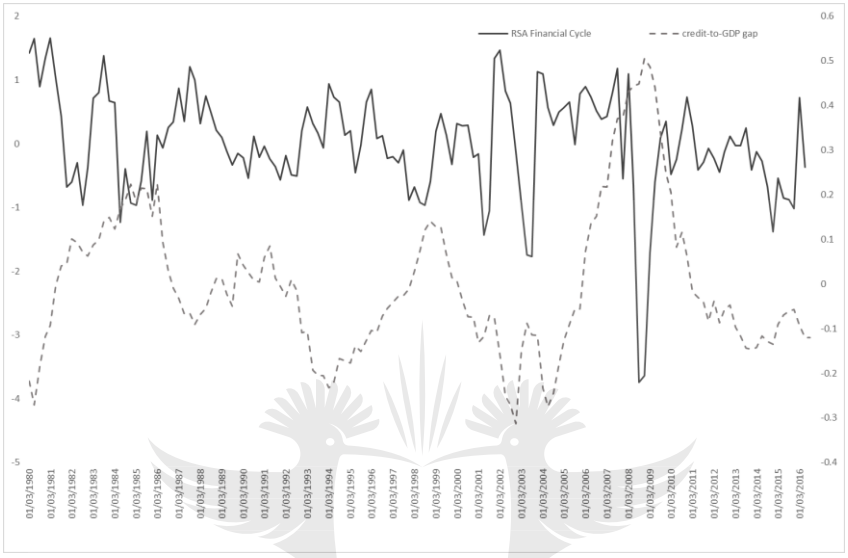


Figure 5: South African financial cycle and credit-to-GDP gap, 1980 to 2016

One way to disentangle periods driven by common versus idiosyncratic factors is by comparing two measures of the financial cycle. Currently, the South African Reserve Bank measures the South African cycle based on the parsimonious relationship between credit, house prices and equity prices (SARB, 2015). Conversely, the financial cycle extracted in this study is based on a time-varying financial conditions index (FCI), like Hatzius *et al*. (2010) for the USA and Kabundi and Mbelu (2017) for South Africa. Given that both include equity prices under different assumptions, strong positive co-movement between the two measures would provide evidence against idiosyncratic periods over the sample.

Figure 6 compares the correlation between the extracted financial cycle and an estimate of the SARB financial cycle. While the SARB uses the Christiano and Fitzgerald (2003) band-pass filter, this study uses factor analysis to replicate the cycle with the same set of variables for comparison. Despite using a different methodology, the estimated SARB cycle appears significantly smoother than the extracted cycle. With a correlation coefficient of 22% (Table 4), the two series exhibit a weak positive

relationship, with the estimated SARB cycle leading the extracted cycle, except after the 2007/2008 crisis.

Upswings from both cycles appear to be relatively aligned, although the estimated SARB financial cycle captures a stronger 2007/2008 crisis risk build-up with a longer duration beginning in 2000. Moreover, neither the 1983/1984 peak, nor the potential idiosyncratic period from 1999 to 2003, are captured by the estimated SARB financial cycle. Conversely, downswings from the estimated SARB cycle appear to deepen, except following the 2007/2008 crisis. The end of the sample also differs between the series, with the estimated SARB cycle reporting an upswing while the extracted financial cycle is declining. Rather than reflecting the end-point problem characteristic within filtering techniques, this is more likely due to the lower frequency of the SARB cycle compared to the extracted cycle. Since equity prices are included in both measures, the higher frequency of the extracted financial cycle is likely due the explicit inclusion of variables that attempt to capture common external movements.

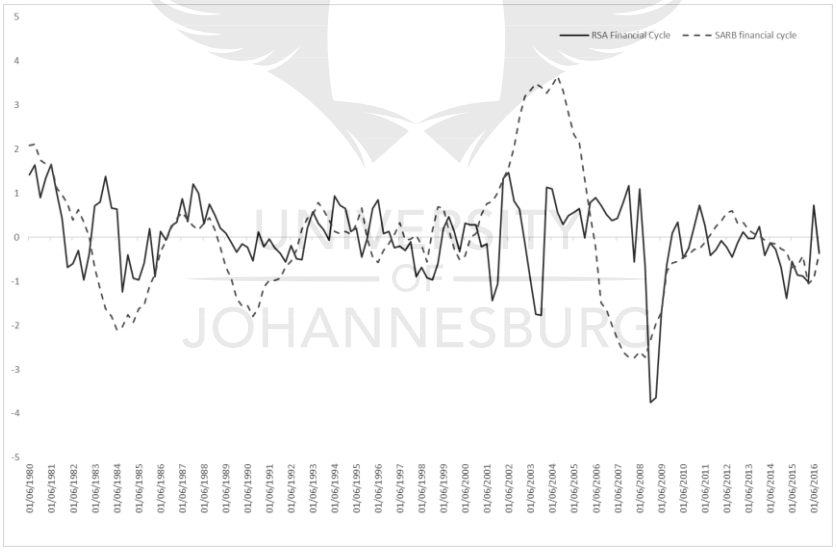


Figure 6: Extracted South African financial cycle and SARB financial cycle, 1980 to 2016

Note: Following Drehmann *et al*. (2012a), the SARB (2015) estimates the financial cycle with total credit, residential property prices and equity prices as indicators using the Christiano and Fitzgerald (2003) band-pass filter. This paper uses factor analysis to replicate the SARB financial cycle with the same variables deflated by the consumer price index, logged and expressed as four-quarter changes. All series are standardised, with one factor being chosen to explain the common variance among the three variables.

Given stronger evidence for the role of common external factors and potential idiosyncratic periods, a more direct way to disentangle common from idiosyncratic periods is by comparing measures of the domestic and global financial cycle. Stronger positive co-movement between the two series would provide evidence of common

external factors driving the domestic cycle. To that end, Figure 7 shows the correlation between the extracted South African financial cycle and the Miranda-Agrippino and Rey (2018) global financial cycle. It is evident from the graph that the series generally co-move throughout the sample, with evidence of a slight lead in the global financial cycle until the 2007/2008 global financial crisis. This is corroborated by a moderate positive correlation coefficient of about 45% (Table 4) for both global samples.

From 1980 to 1996, the series appear to follow each other rather closely, except for the South African financial cycle showing a higher amplitude over the gold price and spending booms during the early 1980s. Additionally, the global financial cycle appears to show a slight lead (with potentially stronger transmission) in relation to the South African cycle over this period. The strength of transmission may be inferred by the close synchronicity to the global trough in 1982 and the global peaks of 1983 and 1987. Therefore, despite not being captured by the SARB financial cycle estimate, the 1983/1984 spending boom appears to be driven by common global factors. Specifically, another brief boom in the gold price boosted capital inflows, rand appreciation and rising gold and foreign reserves. Therefore, the potential strength of global transmission may be indicative of stronger financial linkages through higher levels of foreign liabilities over this period (Balakrishnan *et al*., 2011).



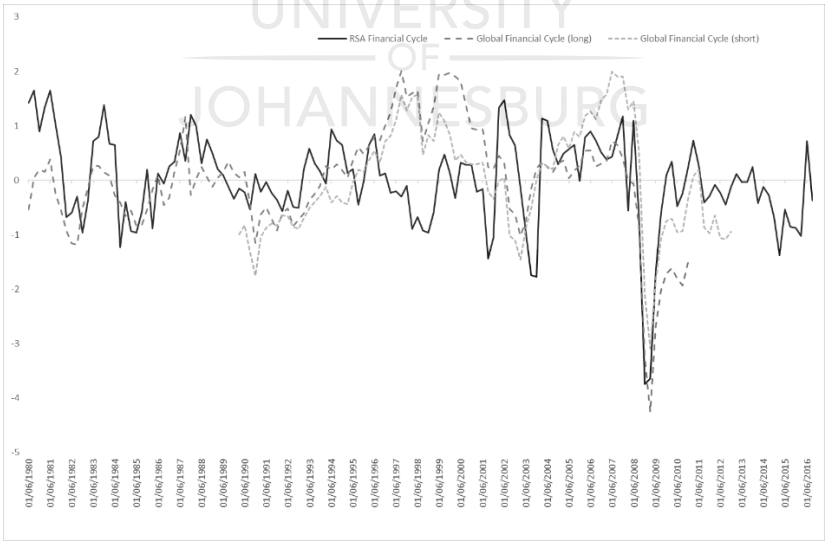


Figure 7: South African financial cycle and global financial cycle, 1980 to 2016

Note: The global financial cycle is obtained from the Miranda-Agrippino and Rey (2018) long- and short-sample global factors. The long sample covers the period 1975 to 2010 and the short sample covers the period 1990 to 2012. The global factors are extracted using dynamic factor analysis and standardised for comparability to the South African financial cycle.

During the early 1990s, both series increased due to the global rise in technology that boosted equities. While the global financial cycle appears to reflect the build-up to the Dotcom Bubble over the decade, the South African financial cycle appears more volatile. From 1994 to 1995, the South African financial cycle contracts briefly due to political and economic uncertainty surrounding the democratic transition at the time (SARB, 1994). Moreover, while the global financial cycle continues a steep ascent until the AFC in 1998, the South African financial cycle enters a downswing from 1996 to 1998. This provides strong evidence for domestic or regional idiosyncratic factors driving the realisation of actual defaults in the South African financial cycle from 1996 to 1998. Additionally, the global financial cycle appears to have a stronger lead (with potentially weaker transmission) over the South African financial cycle following the AFC. Evidence is seen in the global movement between 1997 and 1999, which is only captured by the South African financial cycle between 1999 and 2000. This potentially weaker transmission could be explained by lower foreign liabilities in South Africa due to higher regional EMDE risk following the AFC.

Table 4: Correlations between South African financial cycle, the global financial cycle and VIX

| | **Global financial cycle (long)** | **Global financial cycle (short)** | **VIX** | **Credit-to-GDP gap** | **SARB financial cycle** |
|---|---|---|---|---|---|
| **RSA financial cycle** | 0.434 | 0.456 | -0.616 | -0.335 | 0.222 |



Over the early millennium period, from 1999 to 2003, both series contract together as risk sentiment in the main financial centres began to turn against EMDEs,[39] including South Africa (SARB, 1998). Significant capital outflows caused massive currency depreciations amidst falling commodity prices. Despite relative macroeconomic stability and a sound financial system, South Africa experienced large bond market sell-offs, which represented the primary transmission mechanism of the AFC (SARB, 1999). However, supporting previous evidence of a domestic idiosyncratic period, the series temporarily diverge from 2001 to 2003. This was most likely caused by severe currency destabilisation, when an appreciating rand drove the South African financial cycle upswing from 2001 to 2002. As the speculative rand bubble burst in early 2002,

[39] EME sentiment was further damaged by Russia's emergency rouble depreciation and unilateral external and domestic debt restructuring (SARB, 1998).

the South African financial cycle responded with a sharp downswing as mass currency sell-offs drove a depreciating rand until late 2003.

Leading up to the recent crisis, excessive global credit extension, backed by exotic equity derivatives and real estate booms, led to substantial levels of rising default risk from 2004 to 2008. As the boom turned to bust and the crisis erupted, both series declined sharply as asset values plummeted, currencies lost value and massive global credit defaults were realised. While the global financial cycle began turning from its peak in early 2007, the South African financial cycle followed a year later, in early 2008. To avoid a global depression, AEs began quantitative easing to stabilise their economies in late 2008. This resulted in a partial global rebound from 2009, which marked the beginning of the great recession. Despite fears of a double-dip US recession and a European debt crisis, EMDEs like South Africa managed to attract significant capital inflows due to lower regional risk aversion and favourable interest rate differentials from 2009 to 2012.

While both cycles have remained relatively stable since 2011,[40] there is evidence that the relationship between the two series might have changed following the crisis. Since 2009, the relationship appears to be contemporaneous, albeit with varying magnitudes. On the one hand, this could suggest an increase in the strength and speed of global transmission to the South African economy. It could also, however, reflect the post-crisis search for yield based on idiosyncratic EMDE risk perception. Moreover, the taper tantrum in 2013 may have caused a divergence towards a possible third idiosyncratic period, from 2014 to 2016. Given that the lead-lag relationship is not explicitly tested in this study, the strength and speed of transmission can only be inferred. However, the results confirm a moderately procyclical relationship between common global financial movements and the South African financial cycle.

[40] The Miranda-Agrippino and Rey (2018) global financial cycle is only available until the end of 2012.

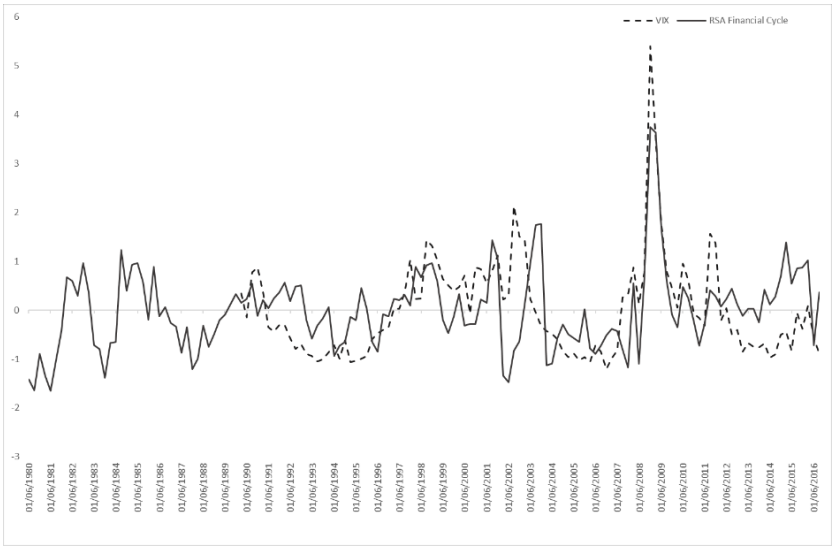


Figure 8: South African financial cycle and CBOE VIX, 1980 to 2016
Note: The CBOE VIX series, collected from FRED, only begins in 1990

Finally, an analysis of the co-movement between the South African financial cycle and the VIX may provide further insight into idiosyncratic periods. Therefore, Figure 8 shows the correlation between the South African financial cycle and the CBOE VIX, with the negative value of the financial cycle used here for better comparison. As mentioned in the literature review, the VIX is commonly used as a measure of global market uncertainty and risk aversion, which is inversely related to the global financial cycle (Miranda-Agrippino & Rey, 2018). Similarly, with a correlation of -62% (see Table 4), the South African financial cycle and the VIX exhibit a moderately strong negative relationship.



Confirming the idiosyncratic build-up of EMDE regional risk from 1996 to 1998, global uncertainty and risk aversion rose due to EMDE debt restructuring, the Mexico crisis in 1995 and the AFC in 1997 (Park & Mercado, 2014). Despite this rise in global risk aversion, the global financial cycle continued its upswing, while the South African financial cycle responded with a significant contraction as large defaults were realised until the end of 1999. This result is consistent with Park and Mercado (2014), who find greater turmoil in individual EMDE financial systems during EMDE crises.

The second idiosyncratic period, from 2001 to 2003, is also confirmed, with high global risk aversion alongside rising domestic default risk and low global risk aversion during the massive rand depreciation in 2001. Despite the September 11 attacks in the USA, the Turkish stock market crash and the Latin American financial crisis, global risk

aversion began descending to its lowest levels following US and UK decisions to invade Iraq. As the war on Iraq erupted in 2003, low global risk aversion sustained an expanding global and domestic financial cycle until the end 2007, when the first signs of a crisis emerged. The VIX then began an ascend to its highest levels as global uncertainty and risk aversion rose during the 2007/2008 financial crisis. As unconventional monetary policy from AEs drove market certainty, the VIX began a descent, reaching its average in 2010.

Interestingly, however, the relationship appears to have weakened after the crisis, with low global risk aversion alongside a falling domestic financial cycle. This provides strong support for the idea of a possible third idiosyncratic period, from 2014 to 2016. Despite the European debt crisis that began in 2011 and the geopolitical risk from the Arab Spring, beginning in 2012, global risk aversion has been returning to levels last seen before the crisis. Conversely, events such as the fall of Africa Bank in 2014, the shuffling of finance ministers since 2015 and the continuing political uncertainty appear to be raising South African risk relative to other EMDEs (Kabundi & Mbelu, 2017). Therefore, this suggests that the South African financial cycle has a stronger response to changes in global risk aversion based on idiosyncratic EMDE risk factors.

Taken together, these results suggest that the South African financial cycle is not isolated from common global financial movements. South Africa is often classified as a middle-income EMDE in Africa (World Bank, 2018). Most middle-income EMDEs are often characterised by weakly capitalised financial markets with low levels of global integration. However, the South African financial market is well capitalised and highly advanced (SARB, 2018b). Moreover, the South African financial system is sound and highly integrated into the global financial market. Therefore, it should come as no surprise that part of South Africa's financial procyclicality is determined by common global fluctuations.

## Summary of Findings

Based on the results, the following conclusions may be drawn about South Africa's financial cycle:

1. The South African credit cycle is weakly countercyclical to the business cycle, possibly suggesting that credit growth might lag behind real domestic output.

While asset prices play a significant role leading up to the global financial crisis, other factors determine the potential for excessive private sector credit growth. Specifically, commodity price, exchange rate, structural and regulatory changes also play a role in determining domestic credit growth. This suggests that various factors may contribute to cyclical fluctuations that characterise the South African macro-financial system.

2. The South African financial cycle appears to be driven by common systematic movements in the funding, credit, equity and global markets. Banking sector leverage is found to be countercyclical (rising during downswings) and contributes the highest share to common movements. This may be used to confirm the countercyclicality of South Africa's credit market. Additionally, leverage has the lowest response to changes in common fluctuations. Conversely, the business cycle, short-term interest rates and global commodity markets have the highest response to changes in common domestic fluctuations. Therefore, the global market contributes a significant share, with an equally high response to changes in common movements.

3. The South African financial cycle has a moderately positive relationship with the global financial cycle. This suggests a procyclical relationship, with evidence of a slight lead in global fluctuations. Additionally, the South African financial cycle has a moderately strong negative relationship with the VIX. This suggests a stronger response to changes in global risk aversion based on idiosyncratic EMDE risk factors. Taken together, this implies that the South African financial cycle is not isolated from common global financial movements. Given a highly advanced and globally integrated financial market, we can infer that South African post-crisis public sector debt growth may partly be driven by monetary policy at the centre.

# Policy Recommendations

## EMDE risk factors

Despite a significant rebound since the great recession, global growth remains fragile due to differences between AEs and EMDEs. Particularly, while AEs show continued

strength with above-average growth levels, expectations among EMDEs remain mixed. For commodity-importing EMDEs, growth prospects appear to remain favourable. However, growth in commodity-exporting EMDEs is expected to mature over the medium term. Moreover, the ongoing withdrawal of accommodative monetary policy in AEs has resulted in a tightening of global financing conditions, with significant consequences for EMDEs across the board (World Bank, 2018).

Since 2013, rising global interest rates and stronger US dollar appreciation have raised the external finance premium, depreciated currencies and reduced capital inflows to EMDEs. Consequently, as appetite continues to wane for higher yielding EMDE debt, borrowing costs have risen, with deteriorating credit quality placing additional pressure on credit rating downgrades for these economies. As such, global investors have become more perceptive in differentiating among EMDEs based on interest rate exposure and currency volatility, despite continued sovereign issuance from these countries.[41]

With medium-term expectations of further reductions in capital flows, EMDEs appear to face significant downside risks as prospects of faster paced increases in global interest rates abound. From the perspective of policy considerations, this requires a strong focus on rebuilding policy buffers to withstand the potential unintended consequences of global financial spill-overs. In addition, with changing global export demand, rising trade protectionism, and policy uncertainty, EMDE policymakers should consider longer term structural changes aimed at boosting competitiveness and adaptability to technological change.



## South African risk factors

The results from the previous section support both global and national findings; however, they also raise questions around the susceptibility of the South African macro-financial system to changes in the global financial cycle and global risk aversion. While an empirical analysis of national susceptibility is beyond the scope of this study, for EMDEs like South Africa it appears to depend heavily on the state of existing idiosyncratic vulnerabilities (Byrne & Fiess, 2016). For South Africa, such

[41] Despite decreases in credit quality among EMDEs, international bond issuance remains strong, mostly driven by rising corporate borrowing in China and sovereign issuances in Sub-Saharan Africa (World Bank, 2018).

vulnerabilities appear to come from three areas: (1) a fragile domestic fiscal position and changing composition of externally denominated debt, (2) coinciding downward phases of the business and financial cycles, and (3) rising trade protectionism and changing patterns of global demand.

*Fiscal Fragility and Changing Composition of Externally Denominated Debt*

Despite recent efforts towards fiscal consolidation and debt stabilisation, South Africa's public sector financial position remains vulnerable (SARB, 2018a). This is driven primarily by rising contingent exposure to state-owned enterprises (SOEs) like Eskom and the Road Accident Fund. Rising liquidity shortfalls among SOEs may place additional upward pressure on government guarantees, should these enterprises roll debt over the medium term. This may increase the already substantial borrowing requirement, leading to further credit rating downgrades, which may result in a negative feedback loop through investor perceptions and the domestic banking sector. Additionally, changes in the composition of external public sector debt since democracy appear to be a cause for concern.

In the aftermath of the global financial crisis from 2010 to 2017, South African total gross loan government debt has been increasing steadily, from around 40% to 50% of GDP (SARB, 2018a). While domestic debt contributes the largest share, rand-denominated external debt held by non-residents has been increasing over the period. Concerning the literature, balance sheets with large foreign currency liability exposure present the highest systemic risk (Desai *et al*., 2008; Feyen *et al*., 2017; World Bank, 2018). Therefore, a brief examination of South African external debt dynamics is warranted.

From 1994 to 2017, South African total external debt,[42] in US dollar terms, increased at a compounded annual growth rate of 8.0% (SARB, 2018a). By the end of 2017, this amounted to US$173.3 billion,[43] with government bonds comprising 86.6% of total debt securities. Over the same period since democracy, the composition has shifted away from US-denominated foreign currency debt to rand-denominated debt held by non-resident investors. On the one hand, this reflects the growing share of diversified

[42] Defined as all domestic and foreign currency-denominated liabilities of residents that require principal and/or interest repayment to non-residents (SARB, 2018a).
[43] This amounts to R2 131 billion, comprising other debt of R1 094 billion (of which 29% is private sector loans and deposits) and debt securities of R1 037 billion (SARB, 2018a).

non-resident asset investment due to the great recession search for yield. On the other hand, it also reveals the growing share of total external liabilities accruing to general government (42% in December 2017).

Over the period since democracy, South Africa's share of total foreign currency external debt denominated in US dollar terms has grown by a mediocre compounded annual growth rate of 5.6% (SARB, 2018a). Since 2002, this has been driven mainly by banking and non-financial private sector short-term other debt.[44] While the repayment schedule of just over half of this debt (53.3%) is due in the short term, the majority occurs within FDI multinational relationships, which tend to be rolled over to the longer term. Conversely, the share of total rand-denominated external debt in US dollar terms has risen by a faster paced compounded annual growth rate of 11.5% (SARB, 2018a). This is attributed mainly to non-resident investor search for yield and the 2012 inclusion of South Africa in the Citi World Government Bond Index.

Moreover, since the financial crisis, growth in the issuance of rand-denominated general government bonds held by non-residents has increased from 8.6% in 2008 to 31.8% in 2017 (SARB, 2018a). This increase appears indicative of fiscal deficit-funding requirements for infrastructure upgrades in the transport and energy sectors over the period. Additionally, growth in total banking sector holdings of government bond and Treasury bill assets has increased by about 82% since 2012 (SARB, 2018a). While this may reflect the consequences of regulatory adherence,[45] it may also reflect growing banking sector susceptibility to unwelcomed global changes through external public sector exposure.

*Coinciding Downward Phases of the Business and Financial Cycle*

The South African business cycle has been in a downward phase since the end of 2013, with the financial cycle following suit since the end of 2016 (SARB, 2018a). Reflective of subdued macroeconomic conditions, this is confirmed by downswings in credit and asset prices since the end of 2012. As discussed in the literature review, coinciding downward phases of the business and financial cycle may result in deeper

[44] The value of other debt comprises loans and deposits that reflect private, public and monetary sector borrowing (SARB, 2018a).

[45] The Basel III liquidity coverage ratio (LCR) requires increased proportions of higher yielding assets for the management of banking sector liquidity between shorter dated funding and medium- to long-term credit extension (SARB, 2018a).

and more protracted recessions. This could increase unemployment, raise debt levels and reduce debt service ability, which would translate into higher impairments and reduced asset quality in the banking sector. Moreover, the introduction of IFRS 9[46] may be exacerbated and place additional pressure on banking capital and reserves in such an environment.

*Rising Trade Protectionism and Changing Patterns of Global Demand*

Recent prospects of rising US trade protectionist measures could reverse the improvements in global growth since the financial crisis. Specifically, should the US continue raising import tariffs over the medium term, this could raise the risk of retaliatory measures, spur on a trade war and lead to a global recession (SARB, 2018a; World Bank, 2018). From a domestic financial-stability perspective, this may raise global inflation while reducing global growth, asset prices and exports. Moreover, as major EMDEs shift towards less commodity-intensive activities, threats of changing global demand may dampen commodity prices, resulting in lower export revenues for commodity-exporting countries like South Africa.

Therefore, South Africa appears to face significant medium-term susceptibility to global spill-overs through public sector financial fragility, lower growth prospects and changing global demand. While private sector credit risk appears to be contained within domestic multinationals, large, external public sector exposure may still pose substantial financial stability risks should South Africa experience a US monetary policy shock. Taken together, this raises South Africa's vulnerability to lower investor confidence, higher asset price volatility and significant credit default risk. However, the possibility of a global financial cycle as an international transmission mechanism creates some opportunities for policy design and implementation. Practically, this calls for policy to be designed with enough flexibility to lean against the changing global patterns while still enabling a strong focus on national objectives. Specifically, it requires a combination of strategically flexible short- to medium-term measures that both *prepare* and *restore* policy scope for the implementation of more aggressive, longer term macroeconomic policy.

[46] The International Financial Reporting Standard (IFRS) 9 for financial instruments became effective in January 2018 and follows the expected credit loss (ECL) model, which came about as a response to the global financial crisis (SARB, 2018a).

# Macro-Financial Policy Recommendations

## Short- to medium-term monetary policy

To prepare policy scope for the potential effects of global spill-overs and changing global demand, monetary policy should focus on extending forecast horizons over the medium-term. In the event of severe currency depreciations, temporary capital controls may be considered. While foreign currency intervention appears tempting, it may only temporarily reduce the value of rand-denominated foreign debt while simultaneously lowering short-term cash flows. As an alternative, forecast horizons beyond the traditional 12 to 24 months are designed to lean against the medium-term build-up of aggregate credit imbalances (Borio, 2012; World Bank, 2018). This may reduce the potential for domestic amplification by improving the accuracy and timing of more targeted policies (Borio *et al*., 2001; Botha, De Jager, Ruch & Steinbach, 2017).

Since 2017, the SARB has begun promoting the quarterly projection model (QPM) as the headline model for growth and inflation forecasts (Botha *et al*., 2017; SARB, 2017a). While maintaining the core model[47] in a supporting role, the QPM is used to analyse the nature of shocks on the longer term behaviour of economic forces over time. This is achieved by assuming that monetary policy can only influence the short-run cyclical features of the economy defined by deviations from longer term equilibrium trends. This allows policymakers to better communicate the short-term consequences of policy actions that are based on more accurate, longer term dynamics.[48]

While the QPM is found to outperform random walk models over longer forecast horizons, its main limitation lies in the use of aggregated variables, which fail to capture idiosyncratic disaggregated behaviour (Botha *et al*., 2017). Therefore, while the QPM represents a significant theoretical improvement, it needs to be complemented by the practical use of flexible but targeted capital controls. Given the primary concern of this study, the use of capital controls should be viewed within the context of leaning against changes in cross-border debt flows. Given the changing composition of South African

[47] The core model has served as South Africa's frontline model for growth and inflation forecasts since the implementation of inflation targeting in 2000 (SARB, 2017a).
[48] The medium term can be characterised as three to six years, while the long run is eight years or more (Botha *et al*., 2017).

external debt, policymakers are advised to consider the use of a macroprudential stability levy on systemically relevant exposure to changes in external rand-denominated debt.

Specifically, taxes could be levied on large sales of rand-denominated asset holdings to deter unwelcome capital outflows. Moreover, taxes may be levied on large exposures to non-core[49] external rand-denominated liabilities to lean against capital inflows during expansions. While this may provide a source of state revenue and restrain unwelcome balance-sheet movements, additional attention needs to be paid to changes in the strength of domestic transmission channels, which depend on the institutional and regulatory environment (Igan *et al*., 2011).

From the literature is appears that the exchange rate channel in South Africa responds rapidly to contractionary policy with a temporary appreciation (Gumata, Kabundi & Ndou, 2013). While short-term capital outflows are deterred, exports and aggregate demand experience a temporary decline that influences the current account after a year. Moreover, externally exposed domestic balance sheets are more likely to experience stronger temporary asset-side improvement rather than liability-side weakness. While empirically testing the current strength of these channels is beyond the scope of this study, some inferences can be made by looking at changes in the domestic institutional and regulatory environment.

Since the fall of Africa Bank in 2014, policymakers have made significant improvements to regulations with the implementation of the Financial Services Regulation Act No. 9 of 2017. As discussed in the literature, the Twin Peaks regulatory framework aims to create an environment of financial stability to support balanced and sustainable growth. Specifically, the Financial Sector Conduct Authority (FSCA), which replaced the Financial Services Board, has made significant improvements in monitoring external business and consumer exposure to financial products such as unit trusts and pension funds. Similarly, the Prudential Authority (PA) – operating through the SARB – has made improvements in monitoring systemic risk by publishing measures of the financial cycle and a financial conditions index (FCI).

[49] For example, FX derivatives positions.

Based on such regulatory improvements, domestic transmission channels are likely to be strengthened significantly. Therefore, policymakers are still faced with the challenge of managing potentially significant capital flow reversals. Given the longer term consequences of short-term currency intervention, policymakers are advised to consider a range of alternative targeted capital-control measures that deter excessive leverage in unsustainable asset price growth if the vulnerability arises. Such vulnerabilities may be determined using specific macroprudential tools.

## Short- to medium-term prudential policy

Ideally, prudential policy space should be restored during contractions by drawing down on buffers that were created by leaning against the build-up of expansions (BCBS, 2010; Borio, 2012; Miranda-Agrippino & Rey, 2018; Rey, 2013, 2016). In South Africa, however, policy preparation and restoration are complicated by the existing need for public sector balance-sheet repair. Therefore, with a stronger focus on reducing the amplitude of externally exposed banking sector asset values, this study suggests the combined use of balance sheet stress-testing and leverage limits.

*Balance Sheet Stress-testing*

As discussed in the literature review, stress-testing represents one of the tools that is based on reducing global transmission effects using cyclical measures to reduce excessive credit growth (Rey, 2013). Given the challenges associated with the rule-based Basel III CCB in South Africa's countercyclical credit market, a better alternative would be to increase the frequency of targeted financial sector balance sheet stress-testing. Specifically, policymakers are advised to pay close attention to bank and non-bank institutions with higher exposure to rand-denominated external assets.

Given appropriate capital buffers, loan-to-value and debt-to-income ratios can then be used to manage lending behaviour by increasing (decreasing) lending standards during booms (contractions). However, such measures may be subject to political distortions that encourage investment, particular asset classes (Rey, 2013). Therefore, a more prudent option would be to consider measures that directly influence the capacity to take on more leverage.

*Tougher Leverage Limits*

The use of leverage limits represents an attempt to address the effects of global transmission by structurally affecting the procyclicality of leverage (Rey, 2013). As discussed in the literature, the leverage ratio of Basel III may be used as a simple management tool to reduce excessive balance sheet leverage growth. Therefore, to supplement the capital framework, South African policymakers are advised to implement tougher leverage ratios, especially for institutions and corporates that are highly sensitive to changes in financing costs.

## Short- to medium-term fiscal policy

Given the fragile state of South African public sector balance sheets, policymakers are currently faced with limited fiscal buffers to prepare for the potentially negative effects of US monetary policy spill-overs. Public sector debt vulnerabilities emanate from growing shares of domestically issued rand-denominated government bonds held by non-residents. On the one hand, this reflects the increase in non-resident investment that is driven by a search for higher yields. On the other hand, it reflects the rising fiscal-deficit financing required for public corporation restructuring.

Therefore, policymakers are advised to consider targeted levies on international credit flows for financing other than public sector restructuring. Exemptions could be provided for international credit flows towards funding education, healthcare and public infrastructure improvements. Such a policy would reallocate short- to medium-term non-resident debt spending towards higher yielding growth-enhancing investment. Moreover, this should be complemented by improvements in debt management capacity and sustainable lending practices (World Bank, 2018). Given anticipated changes to global export demand, investment selection should also be guided by macroeconomic objectives that support longer term export-sector diversification.

## Long-term macroeconomic policy

South Africa requires a strategic combination of macroeconomic policy reforms to enable the development of long-term fiscal and economic sustainability (Halland *et al*., 2017; Mendes & Pennings, 2017; World Bank, 2018). The role of the state to act as a professional long-term investor should guide the design of fiscal reforms. For example, targeted and well-managed strategic investment funds (SIFs) could be set up to build

long-term fiscal capacity. If these funds are directed towards diversifying the commodity-export sector, they would deepen capital markets and create new investment opportunities for the country.

Based on the literature, increased export diversification and fiscal capacity will strengthen both long-term growth and the ability to withstand global spill-overs (Hesse, 2008; World Bank, 2018). Therefore, the diversification of exports should guide longer term macroeconomic policy away from being resource based to idiosyncratic knowledge and technology based. For South Africa, this could be done by deepening regional trade agreements, increasing support for firms to absorb new technologies, and redesigning education and training programmes (Callen *et al*., 2014; World Bank, 2018).

Increased non-tariff barriers in regional Africa could yield gains through improved value chain integration, competition and productivity. Competitive advantage can then be gained through technology diffusion and adaption in the manufacturing sector, such as increased digitalisation (mobile and internet technologies) or advanced robotics. To avoid displacing long-run employment, education and training policies need to be adapted for available skills to benefit from changing technological and developmental needs.



This can be done by fostering a social, economic and political environment directed towards fusing indigenous African knowledge with current technological advancements. This would improve labour market efficiency while fostering a spirit of entrepreneurship and innovation that is necessary for long-term growth and development sustainability (World Bank, 2018). Taken together, the most appropriate policy to deal with the 'dilemma' appears to be actions directed towards the main sources of concern (Rey, 2013). This can be summarised by a combination of targeted policy frameworks that are flexible enough to lean against the possibility of medium-term domestic macro-financial procyclicality, while generating long-term resilience and growth.

# Conclusion

Since the 2007/2008 global financial crisis, growth in EMDE debt levels has increased significantly in both the private corporate and public sectors. In South Africa, while aggregate private sector credit levels have decreased, public sector debt levels have been increasing steadily over the past ten years. Moreover, with the rise in financial globalisation and the changing composition of foreign government debt, this has raised questions regarding the role of common external factors in explaining such phenomena. Therefore, while the factors that trigger excessive credit and leverage growth may appear to be benign, the mechanism through which the financial cycle propagates the business should be of key importance to policymakers in EMDEs, including South Africa.

It is against this backdrop that this mini-dissertation has questioned the common driving forces behind the systematic build-up of credit default risk in the South African financial system. Specifically, the study has questioned the determinants of the South African financial cycle to ascertain whether or not it is isolated from common global financial movements. If it is found not to be isolated, we can then infer that growth in South African public sector debt levels may be due to external factors rather than country-specific characteristics.



The empirical analysis was conducted in two stages. To begin with, the HP filter was used to extract the South African aggregate private sector credit-to-GDP gap. The aim was to determine whether or not the domestic credit cycle is procyclical to the business cycle. Next, a dynamic factor model was used to extract the common cyclical movements from 13 macro-financial variables that were chosen to represent the entire South African financial system. The goal was to determine the main driving forces behind the domestic financial cycle that arise from co-movements between various sectors of the macro-financial economy.

Based on the empirical evidence, the South African credit cycle appears to be weakly countercyclical to the business cycle. In contrast to financial accelerator theory, this may suggest a lead-lag relationship, in which South African output leads credit growth. Additionally, commodity price, structural, regulatory, exchange rate and asset price changes all affect the potential for excessive domestic private sector credit growth.

Moreover, the South African financial cycle is driven primarily by common movements in the funding, credit, equity and global markets. Interestingly, South African banking sector leverage is found to be countercyclical, with the highest contribution but lowest response to common systematic movements. Additionally, the real-sector, short-term interest rates and global market have the highest response to common movements. Therefore, the global market contributes a significant share, with an equally high response to changes in common movements.

Moreover, the South African financial cycle is shown to exhibit moderately positive co-movement with the global financial cycle. This implies a moderate procyclical relationship, with the possibility of a slight lead in common global fluctuations. Additionally, the South African financial cycle shows stronger negative co-movement with the VIX. This indicates a stronger response to changes in global risk aversion, possibly driven by idiosyncratic EMDE risk perception. Therefore, the South African financial cycle is not isolated from common global movements with higher susceptibility to idiosyncratic EMDE risk aversion. Given South Africa's highly advanced and globally integrated financial market, we can thus infer that South African public sector debt growth may be driven partly by monetary policy changes elsewhere.

Following a ten-year post-crisis period of favourable global financing conditions, reversals of US monetary policy accommodation have begun raising global borrowing costs. Combined with US dollar appreciation, this has caused significant reductions in capital inflows to EMDEs. Additionally, despite robust sovereign issuance in international bond markets, deteriorating credit quality in EMDE debt has led to further credit rating downgrades. Furthermore, AE investors have become more astute in differentiating among EMDEs based on growth expectations, as well as fiscal, interest rate and currency pressures. Given the medium-term expectations of South Africa's weakening fiscal position and low growth prospects, neglecting the insights presented within this study would prove disastrous for maintaining macro-financial stability. Moreover, these results become more pertinent as medium-term expectations of faster paced US interest rates hikes rise in a domestic environment of low growth and vulnerable fiscal position.

Should South Africa experience a US monetary policy spill-over shock, the financial system is likely to experience rising borrowing costs, higher market volatility and

significant asset price losses through bond yields and equities. This may be exacerbated by rising contingent and external government debt exposures, which could raise the borrowing requirement and increase risks of further credit rating downgrades. Moreover, the coinciding downward phases of the business and financial cycles may result in a deeper and longer recession. This combination of rising debt levels and lower growth prospects is likely to result in higher impairments and lower bank asset quality, which may create a negative feedback loop, leading to further domestic contraction and downgrades.

Suggestive of significant monetary policy spill-overs, the results presented in this study appear to challenge the prevailing Mundellian trilemma theory for the South African economy. Specifically, South Africa appears to face a Mundellian 'dilemma', with domestic policy partly dictated by monetary policy changes elsewhere. With the jury still out regarding the consequences of increased financial globalisation, this implies new challenges and considerations for national policymaking. Therefore, this study proposes a strategic combination of short- to medium-term monetary, prudential and fiscal policy measures to support longer term macroeconomic policy objectives.

Practically, monetary policy should focus on extending forecast horizons over the medium term, with the potential use of temporary alternative capital controls in the case of severe currency depreciations. Prudential policy should focus on increased balance sheet stress-testing and tougher leverage limits for banks' higher exposure to external assets and corporations with highly sensitive debt-service costs. Additionally, policymakers should consider the implementation of macroprudential stability levies for systemically relevant exposures to changes in externally denominated debt. Fiscal policy should consider targeted taxes on international credit flows directed to investment other than public sector restructuring. Finally, all measures should be guided by overarching macroeconomic policy directed towards the development of longer term export-sector diversification.

While this study builds on the ongoing research concerning the relationship between post-crisis global and domestic transmission mechanisms, some caveats remain to be explored. Given the theoretical challenges underlying the use of the HP filter, further research would benefit from employing the techniques proposed by Hamilton (2017) or Grant and Chan (2017) for extracting the credit-to-GDP gap in South Africa.

Additionally, explicit testing of the lead-lag relationship between credit and output would provide stronger justification for the argument that the South African business cycle leads credit growth. Moreover, research into the potential fluctuations of credit extension (proxied by loans and advances) without the presence of Basel III capital requirements may provide more accurate insights into the dynamics behind domestic banking-sector leverage.

Moreover, further research into South African debt service ratios (DSRs) that focuses on capturing the joint dynamics of a wider set of variables may prove useful for understanding relative domestic debt unsustainability. Finally, further research into the correlations between domestic and regional EMDE financial cycles with the global financial cycle would be beneficial. This would be further enhanced by including the same variables used to capture the global financial cycle and may provide insight into the strength of regional versus global spill-over effects for South Africa.

Prior to the 2007/2008 global financial crisis, the idea of financial stability being a natural consequence of macroeconomic stability appeared to be valid. However, based on growing evidence of the presence of a global financial cycle, this is shown to be a misguided thought. Moreover, while some crises (like the AFC or 2007/2008 crisis) may become systemic, not all crises affect the entire financial system and thus remain contained in various sectors. While this implies a greater role for gross cross-border flows for domestic financial stability, it also necessitates improvements in the monitoring and measurement of each sector, as well as of the macro-financial system as a whole.

More fundamentally, academics, economists and policymakers require a deeper understanding of the modern monetary nature of our economies. The modern banking system appears to generate 'nominal'[50] rather than real purchasing power. Moreover, as loans have come to create deposits, the power of money to systematically create instability has also risen. Better modelling to capture such changes may thus require a move towards more disequilibrium analysis to capture both systemic and sectoral distortions[51] that arise due to unsustainable domestic and global macro-financial

[50] Financial contracts tend to be set in nominal rather than real terms, with early analysis of the distinction between 'real' and 'nominal' provided in Kohn (1986).
[51] See Borio (2012) and Wicksell (1898).

conditions. Only then would it be possible to fully capture the role of financial cycles and policy effects in the modern macroeconomy.

*"The financial cycle … should not be considered a recurrent, regular feature of the economy, which inevitably unfolds in a specific way i.e. a regular and stationary process. Rather, it is a tendency for a set of variables to evolve in a specific way responding to the economic environment and policies within it."*

(Claudio Borio, 2012)

# Bibliography


Adrian, T. & Boyarchenko, N. (2018). Liquidity policies and systemic risk. *Journal of Financial Intermediation,* 35:45-60. doi:10.1016/j.jfi.2017.08.005

Adrian, T. & Shin, H.S. (2009). Money, liquidity, and monetary policy. *American Economic Review*, 99(2):600-605. doi:10.1257/aer.99.2.600

Adrian, T. & Shin, H.S. (2010a). Financial intermediaries and monetary economics. In *Handbook of monetary economics* (pp. 601-650), vol. 3. Edited by Friedman, B.M. & Woodford, M. San Diego, CA & Amsterdam, The Netherlands: Elsevier. doi:10.1016/B978-0-444-53238-1.00012-0

Adrian, T. & Shin, H.S. (2010b). Liquidity and leverage. *Journal of Financial Intermediation*, 19(3):418-437. doi:10.1016/j.jfi.2008.12.002

Adrian, T. & Shin, H.S. (2014). Procyclical leverage and value-at-risk. *Review of Financial Studies*, 27(2):373-403. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=93914746&site=ehost-live&scope=site

Adrian, T., Covitz, D. & Liang, N. (2015). Financial stability monitoring. *Annual Review of Financial Economics*, 7(1):357-395. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=eoah&AN=37517661&site=ehost-live&scope=site

Agénor, P. & Silva, L.A.P. (2013). *Inflation targeting and financial stability: A perspective from the developing world*. Brasília: Inter-American Development Bank & Banco Central do Brasil. Available from: https://www.bcb.gov.br/pec/wps/ingl/wps324.pdf

Ahking, F. (2014). Measuring US business cycles: A comparison of two methods and two indicators of economic activities. *Journal of Economic and Social Measurement*, 39(4):199-216. doi:10.3233/JEM-150407

Aikman, D., Haldane, A. & Nelson, B. (2015). Curbing the credit cycle. *The Economic Journal*, 125(585):1072-1109. doi: 10.1111/ecoj.12113.

Akinboade, O.A. & Makina, D. (2009). Bank lending and business cycles: South African evidence. *African Development Review*, 21(3):476-498. doi:10.1111/j.1467-8268.2009.00219.x

Albulescu, C., Goyeau, D. & Pépin, D. (2013). Financial instability and ECB monetary policy. *Economics Bulletin*, 33(1):388-400. Available from: http://www.economicsbulletin.com/

Angelini, P., Neri, S. & Panetta, F. (2014). The interaction between capital requirements and monetary policy. *Journal of Money, Credit and Banking*, 46(6):1073-1112. doi:10.1111/jmcb.12134

Aoki, K., Benigno, G. & Kiyotaki, N. (2016). Monetary and financial policies in emerging markets. LSE Working Paper No. 659, London School of Economics, London, UK. Available from: https://www.princeton.edu/~kiyotaki/papers/ABKBankModel4-2016.pdf

Ayala, D., Nedeljkovic, M. & Saborowski, C. (2017). What slice of the pie? The corporate bond market boom in emerging economies. *Journal of Financial Stability*, 30:16-35. doi:10.1016/j.jfs.2017.03.003

Bai, J. & Ng, S. (2002). Determining the number of factors in approximate factor models. *Econometrica*, 70(1):191-221. Available from: http://0-www.jstor.org.ujlink.uj.ac.za/stable/2692167

Balakrishnan, R., Danninger, S., Elekdag, S. & Tytell, I. (2011). The transmission of financial stress from advanced to emerging economies. *Emerging Markets Finance and Trade*, 47(2):40-68. doi:10.2753/REE1540-496X4703S203

Bank for International Settlements (BIS). (2015). *85th annual report*. Basel: Bank for International Settlements. Available from: https://www.bis.org/publ/arpdf/ar2015e.pdf

Basel Committee on Banking Supervision (BCBS). (2010). *Guidance for national authorities operating the countercyclical capital buffer*. Basel: Bank for International Settlements. Available from: https://www.bis.org/publ/bcbs187.pdf

Basel Committee on Banking Supervision (BCBS). (2013). *Basel III: The liquidity coverage ratio and liquidity risk monitoring tools*. Basel: Bank for International Settlements. Available from: https://www.bis.org/publ/bcbs238.pdf

Basel Committee on Banking Supervision (BCBS). (2014). *Basel III: The net stable funding ratio*. Basel: Bank for International Settlements. Available from: https://www.bis.org/bcbs/publ/d295.pdf

Basel Committee on Banking Supervision (BCBS). (2017). *Basel III: Finalising post-crisis reforms*. Basel: Bank for International Settlements. Available from: https://www.bis.org/bcbs/publ/d424.pdf

Baxa, J., Horváth, R. & Vašíček, B. (2013). Time-varying monetary-policy rules and financial stress: Does financial instability matter for monetary policy? *Journal of Financial Stability*, 9(1):117-138. doi:10.1016/j.jfs.2011.10.002

Bebczuk, R., Burdisso, T., Carrera, J. & Sangiacomo, M. (2011). A new look into credit procyclicality: International panel evidence. BCRA Working Paper No. 2011/55, Central Bank of Argentina (BCRA), Buenos Aires, Argentina. Available from: http://www.bcra.gov.ar/pdfs/investigaciones/WP_201155_resumenESP.pdf

Bekaert, G., Hoerova, M. & Lo Duca, M. (2010). Risk, uncertainty and monetary policy. *Journal of Monetary Economics*, 60(7):771-788. doi:10.1016/j.jmoneco.2013.06.003

Beltran, D., Garud, K. & Rosenblum, A. (2017). Emerging market nonfinancial corporate debt: How concerned should we be? IFDP Notes, Board of Governors of the Federal Reserve System, Washington DC. Available from: https://www.federalreserve.gov/econres/notes/ifdp-notes/emerging-market-nonfinancial-corporate-debt-how-concerned-should-we-be-20170601.pdf

Bernanke, B.S., Gertler, M. & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In *Handbook of macroeconomics* (pp. 1341-1393), vol. 1. Edited by Taylor, J.B. & Woodford, M. Amsterdam, The Netherlands: Elsevier. doi:10.1016/S1574-0048(99)10034-X

Bernstein, J., Raputsoane, L. & Schaling, E. (2016). Credit procyclicality and financial regulation in South Africa. *South African Journal of Economic and Management Sciences*, 19(4):467-478. Available from: https://0-search-proquest-com.ujlink.uj.ac.za/docview/1847522940?accountid=13425

Besomi, D. (2006). Tendency to equilibrium, the possibility of crisis, and the history of business cycle theories. *History of Economic Ideas*, 14(2):53-104. Available from: http://0-www.jstor.org.ujlink.uj.ac.za/stable/23722797

Beveridge, S. & Nelson, C. (1981). A new approach to decomposition of economic time series into permanent and transitory components with particular attention to measurement of the business cycle. *Journal of Monetary Economics*, 7:151-174. doi:10.1016/0304-3932(81)90040-4

Blanchard, O., Dell Ariccia, G. & Mauro, P., 2010. Rethinking macroeconomic policy. *Journal of Money Credit and Banking*, 42(1):199-215. doi:10.1111/j.1538-4616.2010.00334.x

Borio, C. (2012). *The financial cycle and macroeconomics: What have we learnt?* BIS Working Paper No. 395, Bank of International Settlements, Basel, Switzerland. Available from: https://www.bis.org/publ/work395.pdf

Borio, C. & Lowe, P. (2002). Assessing the risk of banking crises. *BIS Quarterly Review*, December:43-54. Available from: https://www.bis.org/publ/qtrpdf/r_qt0212.pdf

Borio, C., Furfine, C. & Lowe, P. (2001). Procyclicality of the financial system and financial stability:

Issues and policy options. In *Marrying the macro- and micro-prudential dimensions of financial stability* (pp. 1-57), vol. 1. Edited by Bank for International Settlements. Basel, Switzerland: BIS. Available from: https://www.bis.org/publ/bppdf/bispap01.pdf#page=9

Botha, B., De Jager, S., Ruch, F. & Steinbach, R. (2017). *The quarterly projection model of the SARB*. Pretoria: South African Reserve Bank Research Department. Available from: https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/8000/WP1701.pdf

Bouvatier, V., López-Villavicencio, A. & Mignon, V. (2014). Short-run dynamics in bank credit: Assessing nonlinearities in cyclicality. *Economic Modelling*, 37:127-136. doi:10.1016/j.econmod.2013.10.027

Broner, F., Gelos, R.G. & Reinhart, C.M. (2006). When in peril, retrench: Testing the portfolio channel
of contagion. *Journal of International Economics*, 69(1):203-230. doi:10.1016/j.jinteco.2005.05.004

Brunnermeier, M.K. & Sannikov, Y. (2014). A macroeconomic model with a financial sector. *The American Economic Review*, 104(2):379-421. doi: 10.1257/aer.104.2.379

Bruno, V. & Shin, H.S. (2015a). Capital flows and the risk-taking channel of monetary policy. *Journal of Monetary Economics*, 71:119-132. doi:10.1016/j.jmoneco.2014.11.011

Bruno, V. & Shin, H.S. (2015b). Cross-border banking and global liquidity. *Review of Economic Studies*, 82(2):535-564. doi:10.1093/restud/rdu042.

Byrne, J.P. & Fiess, N. (2016). International capital flows to emerging markets: National and global determinants. *Journal of International Money and Finance*, 61:82-100. doi:10.1016/j.jimonfin.2015.11.005

Callen, T., Cherif, R., Hasanov, F., Hegazy, A. & Khandelwal, P. (2014). Economic diversification in the GCC: Past, present, and future. Washington DC: IMF. Available from:https://www.imf.org/external/pubs/ft/sdn/2014/sdn1412.pdf

Carlstrom, C.T., Fuerst, T. S. & Paustian, M. (2010). Optimal monetary policy in a model with agency costs. *Journal of Money, Credit and Banking*, 42(1):37-70. doi:10.1111/j.1538-4616.2010.00329.x

Caruana, J. (2010). Macroprudential policy: What we have learned and where we are going. *Proceedings in Second Financial Stability Conference of the International Journal of*

*Central Banking*. Conducted by the Bank of Spain, Madrid. Available from: https://www.bis.org/speeches/sp100618a.pdf

Castro, V. (2011). Can central banks' monetary policy be described by a linear (augmented) taylor rule or by a nonlinear rule? *Journal of Financial Stability*, 7(4):228-246. doi:10.1016/j.jfs.2010.06.002

Cerutti, E., Claessens, S. & Ratnovski, L. (2017). Global liquidity and cross-border bank flows. *Economic Policy*, 75:81-125. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=122993103&site=ehost-live&scope=site

Chamberlain, G. & Rothschild, M. (1982). Arbitrage, factor structure, and mean-variance analysis on large asset markets. *Econometrica*, 51(5):281-304. doi:10.2307/1912275

Chamon, M. & Garcia, M. (2016). Capital controls in Brazil: Effective? *Journal of International Money and Finance*, 61:163-187. doi:10.1016/j.jimonfin.2015.08.008

Chow, J. (2015). Stress testing corporate balance sheets in emerging economies. IMF Working Papers No. 15216, International Monetary Fund, Washington DC, USA. Available from: https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Stress-Testing-Corporate-Balance-Sheets-in-Emerging-Economies-43324

Christiano, L. & Fitzgerald, T. (2003). The band pass filter. *International Economic Review*, 44(2):435-465. doi:10.1111/1468-2354.t01-1-00076.

Christiano, L., Motto, R. & Rostagno, M. (2014). Risk shocks. *The American Economic Review*, 104(1):27-65. doi:10.1257/aer.104.1.27.

Curdia, V. & Woodford, M. (2010). Credit spreads and monetary policy. *Journal of Money, Credit and Banking*, 42:3-35. doi:10.1111/j.1538-4616.2010.00328.x

Daníelsson, J., Shin, H.S. & Zigrand, J. (2004). The impact of risk regulation on price dynamics. *Journal of Banking and Finance*, 28(5):1069-1087. doi:10.1016/S0378-4266(03)00113-4

De Bandt, O. & Hartmann, P. (2000). Systemic risk: a survey. ECB Working Paper Series No. 35, European Central Bank, Frankfurt, Germany. Available from: http://www.ecb.int/pub/pdf/scpwps/ecbwp035.pdf.

Dell'Ariccia, G., Igan, D., Laeven, L. & Tong, H. (2016). Credit booms and macrofinancial stability. *Economic Policy*, 31(86):299-355. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=114317887&site=ehost-live&scope=site

Desai, M., Foley, C.F. & Forbes, K. (2008). Financial constraints and growth: Multinational and local firm responses to currency depreciations. *Review of Financial Studies*, 21(6):2857-2888. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=35895647&site=ehost-live&scope=site (Accessed: 17 November 2018).

Diamond, D.W. & Dybvig, P.H. (1983). Bank runs, deposit insurance, and liquidity. *Federal Reserve Bank of Minneapolis Quarterly Review*, 24(1):14-23. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=5052260&site=ehost-live&scope=site

Didier, T. & Schmukler, S. (2014). Debt markets in emerging economies: Major trends. *Comparative Economic Studies*, 56(2):200-228. doi:10.1057/ces.2014.4

Didier, T., Llovet Montanes, R. & Schmukler, S. (2016). International financial integration of east Asia and Pacific. Policy Research Working Paper No. 7772, World Bank, Washington DC, USA. Available from: https://openknowledge.worldbank.org/handle/10986/24853

Domanski, D. & Ng, T. (2011). Getting effective macroprudential policy on the road: Eight propositions. Conference proceedings on Macropurdential Regulation and Policy in Seoul on 17–18 January 2011. Conducted by the BIS and the Bank of Korea. Seoul: Bank of Korea. Available from: https://www.bis.org/publ/bppdf/bispap60.pdf#page=103

Drehmann, M. & Juselius, M. (2012). Do debt service costs affect macroeconomic and financial stability? *BIS Quarterly Review*, September:21-35. Available from: https://www.bis.org/publ/qtrpdf/r_qt1209e.pdf

Drehmann, M. & Tsatsaronis, K. (2014). The credit-to-GDP gap and countercyclical capital buffers: Questions and answers. *BIS Quarterly Review*, March:55-73. Available from: https://www.bis.org/publ/qtrpdf/r_qt1403g.pdf

Drehmann, M., Borio, C. & Tsatsaronis, K. (2011). Anchoring countercyclical capital buffers: The role of credit aggregates. BIS Working Papers No. 355, Monetary and Economic Department, Bank for International Settlements, Basel, Switzerland. Available from: https://www.bis.org/publ/work355.pdf

Drehmann, M., Borio, C. & Tsatsaronis, K. (2012). Characterising the financial cycle: Don't lose sight of the medium term! BIS Working Papers No. 380, Bank for International Settlements, Basel, Switzerland. Available from: https://www.bis.org/publ/work380.pdf

Ehrmann, M., Fratzscher, M. & Rigobon, R. (2011). Stocks, bonds, money markets and exchange rates: Measuring international financial transmission. *Journal of Applied Econometrics*, 26(6):948-974. doi:10.1002/jae.1173

Eichengreen, B. (2000). Taming capital flows. *World Development*, 28(6):1105-1116. doi:10.1016/S0305-750X(00)00005-X

Eichengreen, B. (2001). Capital account liberalization: What do cross-country studies tell us?. *The World Bank Economic Review*, *15*(3), pp.341-365. doi:10.1093/wber/15.3.341

Erdem, M. & Tsatsaronis, K. (2013). Financial conditions and economic activity: A statistical approach. *BIS Quarterly Review*, March:37-51. Available from: https://www.bis.org/publ/qtrpdf/r_qt1303f.pdf

Etula, E. (2013). Broker-dealer risk appetite and commodity returns. *Journal of Financial Econometrics*, 11(3):486-521. doi:10.1093/jjfinec/nbs024

Farhi, E. & Werning, I. (2016). A theory of macroprudential policies in the presence of nominal rigidities. *Econometrica*, 84(5):1645-1704. doi:10.3982/ECTA11883

Farrell, G. (2016). Countercyclical capital buffers and real-time credit-to-GDP gap estimates: A South African perspective. *Studies in Economics and Econometrics*, 40(1):1-20. Available from: http://www.ber.ac.za/see/2093.aspx.

Farrell, G. & Kemp, E. (2017). Measuring the financial cycle in South Africa. ERSA Working Paper No. 736, Economic Research Southern Africa, Cape Town, South Africa. Available from: https://econrsa.org/system/files/publications/working_papers/working_paper_736.pdf

Feyen, E., Fiess, N., Zuccardi Huertas, I. & Lambert, L. (2017). Which emerging markets and developing economies face corporate balance sheet vulnerabilities? A novel monitoring framework. Policy Research Working Paper No. 8198, World Bank, Washington DC, USA. Available from: http://documents.worldbank.org/curated/en/414901505845252068/pdf/WPS8198.pdf

Feyen, E., Ghosh, S., Kibuuka, K. & Farazi, S. (2015). Global liquidity and external bond issuance in emerging markets and developing economies. Policy Research Working Paper No. 7363, World Bank, Washington DC, USA. Available from: http://documents.worldbank.org/curated/en/477001467986250331/pdf/WPS7363.pdf

Fleming, M. (1962). Domestic financial policies under fixed and under floating exchange rates. *IMF Staff Papers*, 9(3):369-380. doi:10.2307/3866091

Forbes, K.J. & Warnock, F. E. (2012). Capital flow waves: Surges, stops, flight, and retrenchment. *Journal of International Economics*, 88(2):235-251. doi:10.1016/j.jinteco.2012.03.006

Forbes, K..J., Fratzscher, M., Kostka, T. & Straub, R. (2011). Bubble thy neighbor: Direct and spillover effects of capital controls. Paper presented at the 12th Jacques Polak Annual Research in Washington DC 10-11 November. Conducted by the International Monetary Fund. Washington DC: International Monetary Fund. Available from: http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1456.pdf.

Forni, M., Giannone, D., Lippi, M. & Reichlin, L. (2009). Opening the black box: Structural factor models with large cross-sections. *Econometric Theory*, 25(5):1319-1347. doi:10.1017/S026646660809052X

Fourie, L., Botha, I. & Mears, R. (2011). Credit extension in South Africa: A business cycle perspective for the period 1985 to 2009. *African Journal of Business Management*, 5(34):13074-13083. doi:10.5897/AJBM11.2200

Frankel, J.A. (2017). *How to cope with volatile commodity export prices: Four proposals*. Cambridge MA: Kennedy School of Government, Harvard University. Available from: https://scholar.harvard.edu/files/frankel/files/commodity4proposals2017oct7_0.pdf

Fratzscher, M. (2012). Capital flows, push versus pull factors and the global financial crisis. *Journal of International Economics*, 88(2):341-356. doi:10.1016/j.jinteco.2012.05.003

Gameiro, I.M., Soares, C. & Sousa, J. (2011). Monetary policy and financial stability: An open debate. Economic Bulletin and Financial Stability Report Articles and Banco de Portugal Economic Studies, Economics and Research Department, Banco de Portugal, Lisbon, Portugal. Available from: https://www.bportugal.pt/en-US/BdP%20Publications%20Research/AB201100_e.pdf

Gertler, M. & Bernanke, B. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives*, 9(4):27-48. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=9512181459&site=ehost-live&scope=site

Gertler, M. & Karadi, P. (2015). Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics*, 7(1):44-76. doi:10.1257/mac.20130329

Giese, J., Andersen, H., Bush, O., Castro, C., Farag, M. & Kapadia, S. (2014). The credit-to-GDP gap and complementary indicators for macroprudential policy: Evidence from the UK. *International Journal of Finance & Economics*, 19(1):25-47. doi:10.1002/ijfe.1489.

Gilchrist, S. & Zakrajsek, E. (2012). Credit spreads and business cycle fluctuations. *American Economic Review*, 102(4):1692-1720. doi:10.1257/aer.102.4.1692

Goldberg, L. (2013). Banking globalization, transmission, and monetary policy autonomy. *Svenges Riksbank Economic Review,* (3):161-93, Svenges Riksbank, Stockholm, Sweden. Available from: http://archive.riksbank.se/Documents/Rapporter/POV/2013/2013_3/rap_pov_artikel_5_131122_sve.pdf

Goodhart, C. & Tsomocos, D. (2011). The Mayekawa lecture: The role of default in macroeconomics. *Bank of Japan Monetary and Economic Studies*, 29:49-72, Bank of Japan: Tokyo. Available from: https://www.imes.boj.or.jp/research/papers/english/me29-4.pdf

Grant, A. & Chan, J. (2017). Reconciling output gaps: Unobserved components model and Hodrick-Prescott filter. *Journal of Economic Dynamics and Control*, 75:114-121. doi:10.1016/j.jedc.2016.12.004

Gumata, N., Kabundi, A. & Ndou, E. (2013). Important channels of transmission monetary policy shock in South Africa. SARB Working Paper No. WP/2013/06, South African Reserve Bank, Pretoria, South Africa. Available from: https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/6021/WP1306.pdf

Halland, H., Noel, M., Tordo, S. & Kloper-Owens, J.J. (2017). Strategic investment funds: Opportunities and challenges. Policy Research Working Paper No. 7851, World Bank, Washington, DC, USA. Available from: https://openknowledge.worldbank.org/handle/10986/25168

Hamilton, J.D. (2017). Why you should never use the Hodrick-Prescott filter. *Review of Economics and Statistics* (Ahead of Print), MIT Press Journals. doi:10.1162/rest_a_00706

Harding, D. & Pagan, A. (2002). Dissecting the cycle: a methodological investigation. *Journal of Monetary Economics*, 49(2):365-381. Available from: http://0-

search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=12129441&site=ehost-live&scope=site

Harvey, A.C. & Trimbur, T.M. (2003). General model-based filters for extracting cycles and trends in economic time series. *Review of Economics and Statistics*, 85(2):244-255. doi:10.1162/003465303765299774.

Hatzius, J., Hooper, P., Mishkin, F., Schoenholtz, K. & Watson, M. (2010). Financial conditions indexes:

A fresh look after the financial crisis. NBER Working Paper No. 16150, The National Bureau of Economic Research, Cambridge MA, USA. Available from: http://www.nber.org/papers/w16150.pdf.

Helbling, T., Kose, M.A., Otrok, C. & Huidrom, R. (2011). Do credit shocks matter? A global perspective. *European Economic Review*, 55(3):340-353. doi:10.1016/j.euroecorev.2010.12.009

Hesse, H. (2008). Export diversification and economic growth (English). Commission on growth and development Working Paper No. 21, World Bank, Washington DC, USA. Available from: http://documents.worldbank.org/curated/en/577921468150573677/Export-diversification-and-economic-growth

Igan, D., Kabundi, A., De Simone, F.N., Pinheiro, M. & Tamirisa, N. (2011). Housing, credit, and real activity cycles: Characteristics and comovement. *Journal of Housing Economics*, 20:210-231. doi:10.1016/j.jhe.2011.07.002

Issing, O. (2011). Lessons for monetary policy: What should the consensus be?. IMF Working Paper No. 11-97, International Monetary Fund, Washington DC, USA. Available from: http://www.imf.org/external/pubs/ft/wp/2011/wp1197.pdf.

Jorda, O., Schularick, M. & Taylor, A. (2011). When credit bites back: Leverage, business cycles

and crises. Working Paper No. 2011-27, Federal Reserve Bank of San Francisco, San

Francisco CA, USA. Available from: http://www.frbsf.org/publications/economics/papers/2011/wp11-27bk.pdf

Jorda, O., Schularick, M. & Taylor, A. (2015). Leveraged bubbles. Journal *of Monetary Economics*, 76:S1-S20. doi:10.1016/j.jmoneco.2015.08.005

Kabundi, A. & Mbelu, A. (2017). Estimating a time-varying financial conditions index for South Africa. SARB Working Paper WP/17/02, South African Reserve Bank, Pretoria, South Africa. Available from: https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/8008/WP1702.pdf

Karmakar, S. (2016). Macroprudential regulation and macroeconomic activity. *Journal of Financial Stability*, 25:166-178. doi:10.1016/j.jfs.2016.06.006

Kashyap, A. & Stein, J. (2004). Cyclical implications of the Basel II capital standards. *Economic Perspectives,* 28(1):18-31. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=f5h&AN=12558958&site=ehost-live&scope=site

Kindleberger, C. (2009). Asset inflation and monetary policy. *PSL Quarterly Review*, 62:29-50. Available from: http://ojs.uniroma1.it/index.php/PSLQuarterlyReview/issue/archive.

Kiyotaki, N. & Moore, J. (1997). Credit cycles. *Journal of Political Economy*, 105(2):211-248. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=9706046478&site=ehost-live&scope=site

Klein, M. & Shambaugh, J. (2015). Rounding the corners of the policy trilemma: Sources of monetary policy autonomy. *American Economic Journal: Macroeconomics*, 7(4):33-66. doi:10.1257/mac.20130237

Kohn, M. (1986). Monetary analysis, the equilibrium method, and Keynes's 'general theory'. *Journal of Political Economy*, 94(6):1191-1224. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=5191216&site=ehost-live&scope=site

Koivu, T. (2009). Has the Chinese economy become more sensitive to interest rates? Studying credit demand in China. *China Economic Review*, 20(3):455-470. doi:10.1016/j.chieco.2008.03.001

Koopman, S.J. & Lucas, A. (2005). Business and default cycles for credit risk. *Journal of Applied Econometrics*, 20(2):311-323. doi:10.1002/jae.833

Kose, M.A., Otrok, C. & Whiteman, C.H. (2003). International business cycles: World, region, and country-specific factors. *The American Economic Review*, 93(4):1216-1239. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=10939423&site=ehost-live&scope=site

Laeven, L. & Valencia, F. (2013). Systemic banking crises database. *IMF Economic Review*, 61(2):225-270. doi:10.1057/imfer.2013.12.

Lane, P.R. & McQuade, P. (2014). Domestic credit growth and international capital flows. *The Scandinavian Journal of Economics*, 116(1):218-252. doi:10.1111/sjoe.12038.

Liu, G. & Molise, T. (2018). Is Basel III counter-cyclical: The case of South Africa?. Stellenbosch Working Paper Series No. WP10/2018, The Department of Economics & The Bureau for Economic Research, Stellenbosch, South Africa. Available from: https://www.ekon.sun.ac.za/wpapers/2018/wp102018

Love, I., Martinez Pería, M. & Singh, S. (2016). Collateral registries for movable assets: Does their introduction spur firms' access to bank financing? *Journal of Financial Services Research*, 49(1):1-37. doi:10.1007/s10693-015-0213-2

Lown, C. & Morgan, D. (2002). Credit effects in the monetary mechanism. *Federal Reserve Bank of New York Economic Policy Review*, 8(1):217-235. Available from: http://link.galegroup.com/apps/doc/A87103983/AONE?u=rau_itw&sid=AONE&xid=d08fde46

Ma, Y. & Zhang, J. (2016). Financial cycle, business cycle and monetary policy: Evidence from four major economies. *International Journal of Finance & Economics*, 21(4):502-527. doi:10.1002/ijfe.1566.

Mallows, C.L. (1973). Some comments on Cp. *Technometrics*, 15:661-675. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=2719594&site=ehost-live&scope=site

Mendes, A. & Pennings, S. (2017). *Consumption smoothing and shock persistence: Optimal simple fiscal rules for commodity exporters*. Policy Research Working Paper No. 8035, World Bank, Washington DC, USA. Available from: https://openknowledge.worldbank.org/bitstream/handle/10986/26472/WPS8035.pdf?sequence=1

Mendoza, E. & Terrones, M. (2012). An anatomy of credit booms and their demise. NBER Working Paper No. 18379, National Bureau of Economic Research, Cambridge MA , USA. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=34761723&site=ehost-live&scope=site

Minsky, H. (1982). Can "it" happen again? A reprise. *Challenge*, 25(3):5-13. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=6144901&site=ehost-live&scope=site

Miranda-Agrippino, S. & Rey, H. (2018). US Monetary Policy and the Global Financial Cycle. NBER Working Paper No. 21722, The National Bureau of Economic Research, Cambridge MA, USA. Available from: http://www.helenerey.eu/RP.aspx?pid=Working-Papers_en-GB&aid=224384170_67186463733

Mishkin, F. (2011). How should central banks respond to asset-price bubbles? The 'lean' versus 'clean' debate after the GFC. *Quarter Bulletin, June*. Sydney: Reserve Bank of Australia. Available from: https://www.rba.gov.au/publications/bulletin/2011/jun/pdf/bu-0611-8.pdf

Morais, B., Peydro, J. & Ruiz, C. (2015). The international bank lending channel of monetary policy rates and quantitative easing: Credit supply, reach-for-yield, and real effects.

Policy Research Working Paper No. 7216, World Bank, Washington DC, USA. Available from: http://documents.worldbank.org/curated/en/970971467980551710/pdf/WPS7216.pdf

Morley, J.C., Nelson, C.R. & Zivot, E. (2003). Why are the Beveridge-Nelson and unobserved-components decompositions of GDP so different? *The Review of Economics and Statistics*, 85(2):235-243. doi:10.1162/003465303765299765

Mundell, R.A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economic and Political Science*, 29(4):475-485. doi:10.2307/139336

Ng, T. (2011). The predictive content of financial cycle measures for output fluctuations. *BIS Quarterly Review*, June:53-65. Available from: https://www.bis.org/publ/qtrpdf/r_qt1106g.pdf

Nier, E., Saadi, T. & Mondino, T. (2014). Gross private capital flows to emerging markets: Can the global financial cycle be tamed? IMF Working Paper No. 14/196, International Monetary Fund, Washington DC, USA. Available from: https://www.imf.org/external/pubs/ft/wp/2014/wp14196.pdf

Obstfeld, M. (2009). International finance and growth in developing countries: What have we learned? *IMF Staff Papers*, 56(1):63-111. doi:10.1057/imfsp.2008.32.

Obstfeld, M. (2015). *Trilemmas and trade-offs: Living with financial globalization*. Monetary and Economic Department, BIS Working Paper No. 480, Bank for International Settlements, Basel, Switzerland. Available from: https://www.bis.org/publ/work480.pdf

Obstfeld, M., Shambaugh, J.C. & Taylor, A.M. (2005). The trilemma in history. *The Review of Economics and Statistics*, 87(3):423-438. doi:10.1162/0034653054638300.

Oet, M., Bianco, T., Gramlich, D. & Ong, S. (2012). Financial stress index: A lens for supervising the financial system. Working Paper No. 12-37, Federal Reserve Bank of Cleveland, Cleveland OH, USA. Available from: http://www.clevelandfed.org/research/workpaper/2012/wp1237.pdf.

Park, C. & Mercado, R. (2014). Determinants of financial stress in emerging market economies. *Journal of Banking and Finance*, 45:199-224. doi:10.1016/j.jbankfin.2013.09.018

Passari, E. & Rey, H. (2015). Financial flows and the international monetary system. *Economic Journal*, 125(584):275-698. doi:10.1111/ecoj.12268

Phillips, P.C.B. & Jin, S. (2015). Business cycles, trend elimination, and the HP filter. Cowles Foundation for Research in Economics, Cowles Foundation Discussion Papers: 2005 Yale University, New Haven: Connecticut. Available from: http://cowles.econ.yale.edu/P/cd/d20a/d2005.pdf.

Poledna, S., Thurner, S., Farmer, J.D. & Geanakoplos, J. (2014). Leverage-induced systemic risk under Basel II and other credit risk policies. *Journal of Banking and Finance*, 42:199-212. doi:10.1016/j.jbankfin.2014.01.038

Ravn, M.O. & Uhlig, H. (2002). On adjusting the Hodrick-Prescott filter for the frequency of observations. *The Review of Economics and Statistics*, 84(2):371-375. doi:10.1162/003465302317411604.

Reinhart, C. M. & Reinhart, V. R. (2009). Bonanzas de flujos de capital: Una mirada que abarca el pasado y el presente. [Capital Flow Bonanzas: An Encompassing View of the Past and Present]. *Ensayos sobre Politica Economica*, (59):188–250. Available from: http://0-www.sciencedirect.com.ujlink.uj.ac.za/science/journal/01204483.

Reinhart, C. M. & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly*. Princeton: Princeton University Press.

Repullo, R. & Saurina, J. (2011). The countercyclical capital buffer of Basel III: A critical assessment. CEPR Discussion Papers No. 8304, Centre for Economic Policy Research, London, UK. Available from: http://www.cepr.org/pubs/dps/DP8304.asp.

Rey, H. (2016). International channels of transmission of monetary policy and the mundellian trilemma. *IMF Economic Review*, 64(1):6-35. doi:10.1057/imfer.2016.4.

Rey, H. (2013). *Dilemma not trilemma: The global financial cycle and monetary policy independence. Conference proceedings of Economic Policy Symposium in Jackson*

*Hole*. Conducted by the Federal Reserve of Kansas City. Jackson Hole: Federal Reserve of Kansas City. Available from: http://www.helenerey.eu/RP.aspx?pid=Published-Papers_en-GB&aid=147802013_67186463733

Ritschl, A., Sarferaz, S. & Uebele, M. (2016). The U.S. business cycle, 1867-2006: A dynamic factor approach. *The Review of Economics and Statistics*, 98(1):159-172. Available from: http://eprints.lse.ac.uk/67420/1/US_dynamic%20factor_2016.pdf

Rodrik, D. & Subramanian, A. (2009). Why did financial globalization disappoint? *IMF Staff Papers*, 56(1):112-138. doi:10.1057/imfsp.2008.29.

Schularick, M. & Taylor, A. (2012). Credit booms gone bust: Monetary policy, leverage cycles and financial crises, 1870-2008. *American Economic Review*, 102(2):1029-1061. doi:10.1257/aer.102.2.1029

Schumpeter, J.A. (1939). *Business cycles*. New York: McGraw-Hill.

Shin, H. S. (2012). Global banking glut and loan risk premium. *IMF Economic Review*, 60(2):155-192. doi:10.1057/imfer.2012.6

Smets, F. (2014). Financial stability and monetary policy: How closely interlinked?. *International Journal of Central Banking*, 10(2):263-300. Available from: http://www.ijcb.org/journal/currentissue.htm.

South African National Treasury. (2018). *Strengthening South Africa's resolution framework for financial institutions*. Pretoria: National Treasury.

South African Reserve Bank (SARB). (1981). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1982). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1984). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1988). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1989). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1991). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1997). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1998). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (1999). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2000). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2001). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2005). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2007). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2009). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2011). *Financial stability review*. 2nd edition. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/Reviews/Pages/FinancialStabilityReview.aspx

South African Reserve Bank (SARB). (2015). *Financial stability review*. 2nd edition. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/Reviews/Pages/FinancialStabilityReview.aspx

South African Reserve Bank (SARB). (2016). *A new macroprudential policy framework for South Africa*. Pretoria: South African Reserve Bank, Financial Stability Department.

Available from: https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/7547/Macroprudential%20policy.pdf

South African Reserve Bank (SARB). (2017a). *Monetary policy review, October*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/Reviews/Pages/Monetary-Policy-Review.aspx

South African Reserve Bank (SARB). (2017b). *Quarterly bulletin, December*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2018a). *Quarterly bulletin, June*. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/QuarterlyBulletins/Pages/Quarterly-Bulletin.aspx

South African Reserve Bank (SARB). (2018b). *Financial stability review.* 1st edition. Pretoria: South African Reserve Bank. Available from: https://www.resbank.co.za/Publications/Reviews/Pages/FinancialStabilityReview.aspx

Stock, J. & Watson, M. (2016). Factor models and structural vector autoregressions in macroeconomics. In *Handbook of macroeconomics* (pp. 415-525), vol. 2. Edited by Taylor, J. B & Uhlig, H. Amsterdam, The Netherlands and Oxford, UK: Elsevier. doi:10.1016/bs.hesmac.2016.04.002

Svensson, L. (2012). Comment on Michael Woodford, "Inflation targeting and financial stability". *Sveriges Riksbank Economic Review*, 2012(1):33-39. Available from: https://larseosvensson.se/files/papers/CommentWoodford12.pdf

Terrones, M., Kose, M.A. & Claessens, S. (2011). Financial cycles: What? how? when? IMF Working Paper No. 11/76, International Monetary Fund, Washington DC, USA. Available from: https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Financial-Cycles-What-How-When-24775

Ueda, K. & Valencia, F. (2014). Central bank independence and macro-prudential regulation. *Economics Letters*, 125(2):327-330. doi:10.1016/j.econlet.2013.12.038

Vallageas, B. (2013). Basel III and the strengthening of capital requirement: The obstinacy in mistake or why 'it' will happen again. In *Monetary economies of production: Banking and financial circuits and the role of the state: Essays in Honour of Alain Parguez* (pp.112-133). Edited by Rochon, L.P. & Seccareccia, M. Cheltenham, UK and Northampton, MA: Elgar. Available from: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=ecn&AN=1532804&site=ehost-live&scope=site

Van Vuuren, G. (2012). Basel III countercyclical capital rules: Implications for South Africa. *South African Journal of Economic and Management Sciences*, 15(3):309-324. doi:10.4102/sajems.v15i3.235

Verhoef, G. (2017). The rise of financial services in Africa: A historical perspective. In *Developing Africa's financial services: The importance of high impact entrepreneurship*:3-42. Edited by Redford, D. Bingley, UK: Emerald.

White, W. (2009). Should monetary policy 'Lean or clean'?. Working Paper No. 34, Globalization and Monetary Policy Institute, Federal Reserve Bank of Dallas, Dallas TX, USA. Available from: https://www.dallasfed.org/~/media/documents/institute/wpapers/2009/0034.pdf

Wicksell, K. (1898). *Interest and prices: A study of the causes regulating the value of money*. New York: Augustus M. Kelley.

Woodford, M. (2012). Inflation targeting and financial stability*. Sveriges Riksbank Economic Review,* 2012(1):7-32. Available from: http://archive.riksbank.se/Documents/Rapporter/POV/2012/rap_pov_120210_eng.pdf

World Bank. (2018). *Global economic prospects, June*. Washington DC: World Bank Publications. Available from: http://www.worldbank.org/en/publication/global-economic-prospects

Xu, T. (2012). *The role of credit in international business cycles*. Working Paper No. 2012-36, International Economic Analysis Department, Bank of Canada, Ottawa, Ontario, Canada. Available from: https://www.banqueducanada.ca/wp-content/uploads/2012/11/wp2012-36.pdf

Zigrand, J. P., Danielsson, J., & Shin, H. S. (2009). *Risk appetite and endogenous risk.* FMG Discussion Papers No. 647, Financial Markets Group, London School of Economics, London, UK. Available from: http://www.lse.ac.uk/fmg/assets/documents/papers/discussion-papers/DP647.pdf

# Appendix

## Table A: List of variables

| No. | Description | T-code | S-code |
|---|---|---|---|
| | **Real sector** | | |
| 1. | Real GDP at market prices (2010 = 100) | 3 | S |
| | **Credit market** | | |
| 2. | Private credit: total credit extended by all monetary institutions to the domestic private sector (market prices) | 3 | S |
| 3. | Term spread: Government bonds 10 years and over – 0 to 3 years | 1 | S |
| 4. | Corporate bond spread: Eskom bonds – Government bonds 0 to 3 years | 1 | S |
| | **Forex market** | | |
| 5. | Exchange rate: real effective rate against the most important currencies (Index: 2010 = 100, averages) | 3 | S |
| | **Real estate market** | | |
| 6. | Property prices: ABSA House Price Index (2000 = 100) | 3 | B |
| | **Funding market** | | |
| 7. | 3-month JIBAR | 2 | S |
| 8. | Leverage ratio: Bank and mutual banks Total Assets/Total Equity (Rmill) ratio | 3 | S |
| 9. | Aggregate Money: Nominal M2 | 3 | S |
| | **Equity market** | | |
| 10. | Equity prices: South Africa Share Price Index | 3 | I |
| 11. | SAVI: SA Volatility Index | 1 | B |
| 12. | Bank volatility: JSE financials index annualised volatility | 1 | B |
| | **Global market** | | |
| 13. | Commodity prices: global commodity price index (market prices and unit values) | 3 | I |
| 14. | Global financial cycle * | 1 | MR |
| 15. | VIX * | 1 | F |

Note: T-code: 1 = Level, 2 = First difference, 3 = Log difference; S-code: S = South African Reserve Bank, I = IMF International Financial Statistics, B = INET BFA, MR = Miranda-Aggripino and Rey (2018), F = Federal Reserve Bank of Saint Louis Economic Data (FRED). * Variables not used in the construction of the South African financial cycle but used in comparison to it.



## Table B: Unit root tests

| Variables | DF-GLS (ERS) | KPSS | | DF-GLS (ERS) | KPSS | |
|---|---|---|---|---|---|---|
| | Level | Level | Decision in case of conflict | 1st difference | 1st difference | Decision in case of conflict |
| Real GDP | I(1) | I(1) | | I(0) | I(0) | |
| Private sector credit | I(1) | I(1) | | I(0) | I(0) | |
| Term spread | I(0) | I(0) | | | | |
| Corporate bond spread | I(0) | I(0) | | | | |
| Exchange rate | I(0) | I(0) | | | | |
| Property prices | I(1) | I(1) | | I(1) | I(0) | I(0) |
| JIBAR | I(0) | I(0) | | | | |
| Leverage ratio | I(1) | I(1) | | I(0) | I(0) | |
| Aggregate money | I(1) | I(1) | | I(0) | I(0) | |
| Equity price | I(0) | I(0) | | | | |
| SAVI | I(0) | I(0) | | | | |
| Bank volatility | I(1) | I(0) | I(0) | | | |
| Commodity prices | I(1) | I(0) | I(1) | I(0) | I(0) | |

Those highlighted in blue showed conflicting results between ERS and KPSS at the 5% level. Following Igan *et al*. (2011), graphical evidence was examined closely, and unit root tests were also done, excluding a constant and trend.